AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

VOLUME 20. NEW YORK, THURSDAY, NOVEMBER 11, 1897. NUMBER 45.

An Acetylene Gas Explosion.

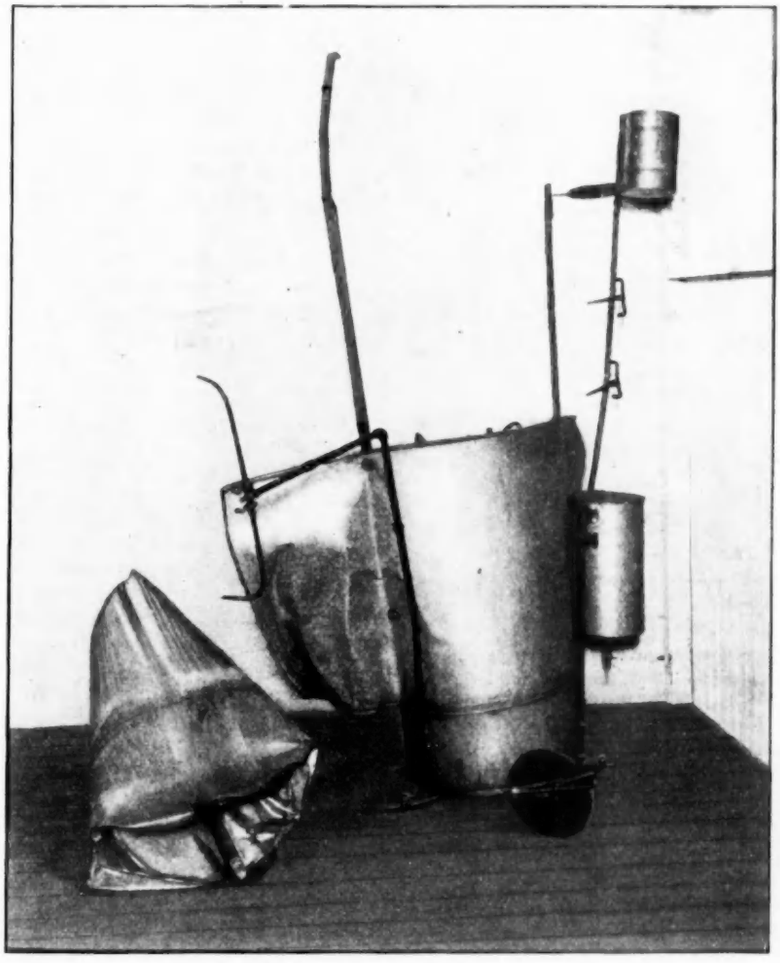
BY E. A. GAY.

An acetylene gas generator exploded in the shop of Valentine J. Long, Jr., at No. 11 Allen street, Rochester, on Monday, October 4th, seriously injuring the proprietor of the shop, two of his workmen escaping with slight hurts.

The construction of the machine will be readily understood from the accompanying diagram, Fig. 1. An open, galvanized iron tank, about 30 inches in diameter, was fitted with an upright iron frame serving to guide an interior gas holder of similar construction, having the usual water seal, and arranged to slide freely up and down within the guiding frame. Attached to the outside of the tank was a close receptacle for the calcium carbide from which the gas is generated, having the necessary piping to convey the gas to the bottom of the tank, where it entered a worm, supported by an interior shell, through which it was cooled, and discharged at the top of the water level inside the gas holder. At the top of the machine was a small water tank piped to the carbide holder, the connections being provided with valves arranged to operate automatically by the raising or lowering of the gas holder, turning on or shutting off the water as the holder was filled or emptied, the simple contact of the water with the carbide being all that is required to generate the gas. A blow-off cock was provided at the top of the gas holder, so that the air could be all let out of the machine before starting the generation of gas. The guiding frame was tied together at the top by a cross-bar.

The apparatus was fitted up with several special burners for the new illuminant, and was placed in an interior room about 15 feet square, reserved for private and experimental uses from the rest of the shop. About 4 feet from where the machine stod was an ordinary gas jet.

The machine was supposed to be in perfect working order, no leaks or bad joints being found after the most careful examination. Following a test of several hours' duration, by officers of the company, Mr. Long was engaged in determining a change in the position of a valve. He was standing on a box reaching over the top of the machine. The two men assisting were standing on the floor at the sides and close to the tank. The gas jet was lighted. The tank had been nearly emptied, not over 6 or 8 inches of gas remaining in the holder, after its use by the members of the company.



GAS HOLDER AFTER EXPLOSION.

Without warning of any kind, the machine suddenly blew up, the interior gas holder being projected directly upward as if fired from a gun. Striking the cross-bar gave resistance enough sideways, so that the outside tank was torn asunder, the sheet metal striking and throwing the two men back against the wall, tearing their clothes and bruising them slightly. Mr. Long, from his position over the tank, received the full force of the explosion, was struck square across the forehead by the projectile and thrown across the room, maimed and bleeding. It was thought that his injuries were necessarily fatal, his skull being fractured, but there now seems to be a good chance of his complete recovery.

It is not known just how the accident

occurred. There was no smell to indicate the presence of a leak or opening of any kind communicating with the body of gas inside the tank. By some means not now fully known, air must have been admitted to the gas while they were at work on the tank, in order to form the explosive mixture. It is thought that in order to test the change he was engaged in determining, Mr. Long must have opened the carbide holder and then raised the gas tank, thereby drawing air in through the carbide holder from the outside; but there is no evidence to show that such was the case, beyond the fact of the explosion. When Mr. Long recovers sufficiently to give an account of the disaster, he may be able to tell how it happened. Fig. 2, from a photograph,

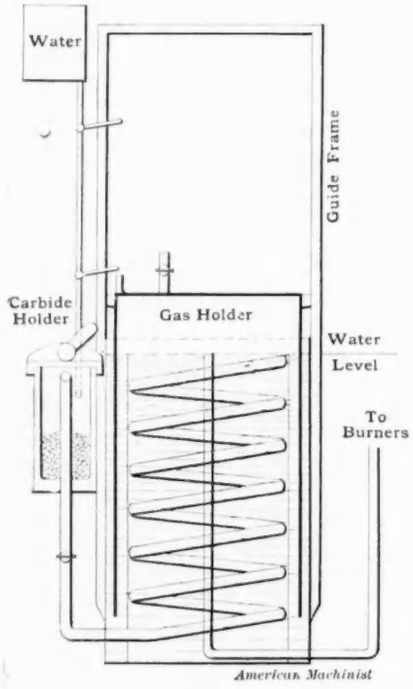


Fig. 1

CONSTRUCTION OF GAS HOLDER.

shows the appearance of the machine after the explosion. The cover of the carbide holder was found loose on the floor, showing no evidence that it had been blown off, the body of the carbide holder being intact. The cock between the carbide holder and the tank was found open.

There may be something about acetylene gas different from other gases, but the presumption is that in this case an explosive mixture was formed by drawing air through the carbide holder into the tank. The explosion may have been spontaneous, for all that is positively known to the contrary, but the apparent conditions do not appear to warrant this assumption.

The gas by itself is no more explosive than any other iluminating gas, and the machine worked all right when tested a short time before, showing that the explosive mixture had not then been made. The most careful men sometimes make mistakes and the officers of the company think that this was one of the times.

However that may be, the fact remains that a machine of this character is a dangerous thing to experiment with.

The fact that the gas in this case happened to be acetylene cuts no figure. The explosive would have followed just the same had ordinary gas been used and an explosive mixture formed with that instead of acetylene. The range between the lowest and greatest amounts of air that will form an explosive mixture with acetylene is quite wide. Experiment has shown that three to four parts of air are required to one of gas before it will explode at all. At 13 to 1 it attains its greatest explosive force, and continues explosive up to 20 to 25 parts of air for one of gas. Above that the mixture is not explosive.

[From additional sources of information it seems reasonably certain that air was admitted to the holder forming an explosive mixture which was fired from the gas jet mentioned by our correspondent.—Ed.]

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The Place of Our Destination—XVI.

Editor American Machinist :

One s opinion of a place is very much affected by his entrance into it. Berlin, sized up in a pouring rain, seemed monstrous large, or at least it was a long way from the station to our pension in the center of the town. Well, in fact, it is a large city, in population. The New York papers gave New York, last spring, 1,750,000, and the Berlin guide books give this city 1,800,000, so if these two authorities lie about equally, Berlin must be the third city, rather than the fourth in size. I speak of New York as it is, and not as it is to be. Like many another of the German cities, Berlin has grown very fast since 1870, probably owing, in a large measure, to the fact that the thousand million francs coming from France on account of the war, had to be used up, and that much extra money put in circulation made things prosperous around the cities.

It is likely that the city was built where it is because of the river Spree, which is navigable up thus far by small craft or boats; but so far as that goes now, it is doubtful if they could not get along without it. It has grown, as cities usually do when there are no natural restrictions, into an oval shape, with its longer axis east and west, and it is along this axis that the principal objects of interest are located.

Starting in at the eastern section, the first building prominently conspicuous is not a building at all, but a place for one. There was a cathedral here, but it did not come up to the Emperor's ideas as to what a cathedral ought to be, so he had it torn down, and a new one is being built in its place.

They have a peculiar way of erecting buildings here, and this is a heroic example of it. When a building is to be erected, the first thing they do is to build a staging all around and over where it is to be, and so, while there is but a start made on this cathedral, the staging gives a complete notion of its size and shape. Not only the outside walls, but the roof, circular colonnade under the dome, and the dome itself are outlined by the staging, and, further, the very ornament itself, or a model of it, which is to crown the structure, is already held up in place it is to occupy, by this staging. One can only wonder whether they are to build down from this ornament, or build up to it and catch it in place. Perhaps the German builders are hustlers, but if not, some of this staging is liable to rot out once or twice before it becomes serviceable. I am rather disposed to give these people credit for knowing what they are about, after seeing what they have accomplished, and it may be that by this method they can carry on the work in enough more places at once to make it pay.

Adjoining the cathedral, or what is to be the cathedral, is the National Museum and Art Gallery on the one side, and the old Castle on the other. This latter was the home of the Prussian kings for some centuries, and there is in front of it a wonderfully fine bronze group set upon an arch, and statues round about everywhere. The paintings in the Art Gallery are of the modern German school, which must either please the public who pay or the artists who make them; but, some way, I did not enthuse, and to see the sights of the museums was too hard work for me. I read some years ago that there was a basin in front of the museum, over 60 feet in diameter, made of a single stone, but never could find anyone who had seen it, and this I determined to find. Well, as a matter of fact, the newspaper man who told the story made the mistake of just 3.1416, in other words, he gave the circumference instead of the diameter. It is, as said, in front of the museum—a basin or vase like a fruit dish; the basin part made of a single red granite block, as near as I could measure, about 63 feet around, or practically 20 feet in diameter. It is 4 feet deep, and carved so perfectly that one can hardly believe it was not turned in a lathe, and polished as we see granite columns and monuments. To realize how large this is, one needs to think twice. A single block of granite, free from flaws, 21 feet in diameter and 4 feet thick; the man who found it made a hit, and the man who thought of what to do with it made another.

The River Spree, either naturally or by the making of a canal, divides and joins again, forming an island, upon which stands the large building I have mentioned, and the bridges spanning these

branches of the river, though small, are embellished with bronze statues on the abutments and piers. Crossing any of these bridges, going west, leads one to the best known of all the streets in the world, Unter den Linden. It was but a few years ago that this was considered the finest street in the world, but to-day the boulevards of Paris and Brussels leave it in the shade, and for no other reason than that the trees are small and scrubby compared to those in the Belgian capital. The buildings are as fine or grander, the road-beds are as good, but the trees (as I pointed out in a former letter) are just that which distinguishes a fine street from an ordinary one. In this connection, I wish to express my gratification at the editorial my London letter called out, for I feel that you are the second real convert I have made, with all my preaching, in defense of narrow road-beds and wide lawns, and I hope in some way to make another before either of us dies. Nothing ever made Unter den Linden a thoroughfare of world-wide reputation but the idea of confining the road-beds to the wants of the traffic and planting the rest with lawns and trees, and this same beauty can be added to every residence street in every provincial city in our country, for the road-beds in all of these are twice or three times as wide and costly, or as poor and dirty, as they need be, and that which makes streets beautiful at a little cost is cast aside.

Along the sides of this east and west artery of Berlin are grouped many of the finest buildings, the Emperor's Palace, the Royal Opera House, a dozen large hotels, and at the west end of it, which may be three-quarters of a mile or a mile from the river, it ends at a triumphal arch built in honor of something, and at the beginning of a large park or woods; for this park is not a park in the sense we usually think of, for much of it is just woods, with natural trees and underbrush, where people can lounge and picnic, or wander at their own sweet will. Germany, I think, as a usual thing, is over-governed; but, compared to the Bois de Bologne, at Paris; the Bois, at Brussels, and this garden at Berlin, our parks are the things that are over-governed with us—too much like the farmer's front parlor, which is often too good to use. "Keep off the grass" always seemed to me to imply that grass was of more consequence than children.

The Reichstag, or Parliament House, is located in the park, and while not as large as either the Capitol at Washington, or the English Houses of Parliament —in fact, it does not seem to be as large as many of our state capitols, it is quite pretentious and resplendent in gold. So too is a monument in honor of the victory over the French in the Franco-Prussian war. I wonder how long it will be before great nations and fair minded people will be ashamed of this sort of thing. France has no right to complain, for she has no lack of monuments to her victories, but it is a foolishness that two can play at. England seems to have had more sense than other nations, and I doubt if she has a single monument of this kind; no other people are so magnanimous to their enemies or adversaries, whether victors or vanquished, as the English.

At one side of, but a block or two away from Unter den Linden, is the Royal Theater, and each side of it a church, both practically alike, and when one comes to think of it, a theater and two churches built for architectural effect, one can realize to what extent the German people or the German rulers will go for looks. Perhaps not as much as in France, but the architects or the powers that control affairs, so arrange things that buildings are built to harmonize with their surroundings, rather than to express a spirit of individuality regardless of surroundings.

Unfortunately I was prevented from seeing many of the interesting mechanical industries of Berlin to which I had gained the keys of admission, but was shown through the salesrooms of Schuchardt & Schütte, who sell American machinery almost exclusively, and this feature struck me as I have come to think it over since; the machinery seemed to be made specially for their market, or they had after it was received, put on their own men and finished it up. I do not know that either of these suppositions is true, but certainly I do not call to mind any store-room or exhibit of American tools that showed the finished appearance that those of the same make had here. In another salesroom where German tools exclusively were sold, their tools too had this finished appearance, the same contrast as to finish that the French exhibit at Brussels showed over the American.

At Berlin I was seemingly beset by misfortune all around. On a visit to the Polytechnic, built in the grandest style with money disgorged from the French, as a payment for their folly in provoking a war, I failed to find a single one of the many professors with whom I was acquainted. This institution is I suppose in many respects the leading one in the world, though the testing department, or the one we visited, did not compare with many of those I have seen at home, but the Reuleaux models, of which I believe there is no such collection anywhere else, I can easily imagine, would be the delight of college profesosrs.

It is certainly a marvelous collection, and they are all very fine pieces of workmanship. The group, or at least all we examined, are simply models of mechanical motions, and in a measure designed to show a number of ways to do the same thing, and to analyze motions and show that a great variety of apparently different ways are simply different forms of the same mechanical principle. As an instance, there were ten or a dozen models to show the different ways in which shafts which run at an angle to each other (like the feed shaft of a Brown & Sharpe milling machine) can be coupled so as to run. Others of various degrees of complication to show how reciprocating motion can be produced from rotating and the reverse, and so through almost an endless variety of devices and motions, with models all in the same style and finish, and all evidently built by the same or equally skillful model makers.

As I said before, to see and have all this must be the delight of most of the technical college professors, but to me it seems that money, when it has to be earned or begged, can be spent to a much better advantage. I do not believe the effect of seeing these things to be a good one. These models are not in any case built like real machines. The details of frame construction would be all wrong in real machines, the connections and bearings are in many cases such as no one of experience would think of using; the student sees the good and bad ways set out in equal splendor, and on the whole I should rather have a student make with his own hands a model of the best way than to see the dozen right and wrong. I am rather glad I saw these things in my own way, for had they been shown me by an enthusiastic professor, it is likely that my courage to express my true sentiments would have failed me. From the foregoing it would appear that I have nothing but adverse criticism for the greatest of polytechnic schools, but that is only because of the circumstances, for as a matter of fact it is not only great in itself and in its equipment, but in what is of far more importance, in its corps of able professors.

Potsdam, a place of palaces, the summer residence of the king, something like 30 miles from Berlin, is one of the sights that one must see before he can say he has seen Berlin. Here is Sans-Souci, the one-story summer residence of Frederick the Great. It is said that when the claim was made that the wars had impoverished the country, Frederick said he would show them, and so built the new palace on a scale of magnificence equal to anything of its time.

When a room is composed of four walls a floor and a ceiling, one cannot describe one so that it will appear to the reader as being very different from another, and so with the rooms in the new palace; it is room after room with beautiful floors, too nice to walk on, walls resplendent with gold bordered panelings and frieze and ceilings in stucco, fresco and carved embellishments.

One room particularly novel and attractive is the grotto salon, arched overhead, in which the walls and ceilings are literally covered with shells, crystals, precious stones, or any odd article that is appropriate, all blended or jumbled together, and I fancy to one who can understand the

thing, would be a mine of interest on account of the historical associations with which many of the curiosities are connected. Many of the things are those Humboldt picked up in his wanderings.

An attractive room in the Sans-Souci Palace is one fitted up by Frederick the Great for Voltaire, who was his right hand man or secretary or something. Voltaire, it seems, was a great lover of nature and an Eiffel tower of a talker, so in its embellishments the King had used flowers that Voltaire liked, to please him, and parrots, emblematic of his talking proclivities, to please himself.

Another thing interesting and historical, is a wind-mill, interesting because it shows how circumstances affect even such a simple thing. One of the large wind-mills, such as I have described as existing in Holland, was located nearer the grounds of the Sans-Souci Palace than suited King Frederick, and he proposed to get rid of it by buying. The owner didn't want to sell, so he proposed to down it anyhow and the owner appealed to the courts for his rights as a citizen. The courts sustained him, and Frederick the Great, respecting the decision, made the mill a thing of reverence, and it could no more be bought now than the palace itself.

Besides the two palaces I have mentioned there are a couple of others. Frederick the Great is buried here in an old church, and a mausoleum where Emperor Frederick is buried, in fact, there was so much to see that the day used me up, and so we were compelled to abandon our journey and turn homeward.

This then to our sorrow is "the place of our destination" in this direction at least, though I hope I may find more worth telling before the end of the return journey.

JOHN E. SWEET.

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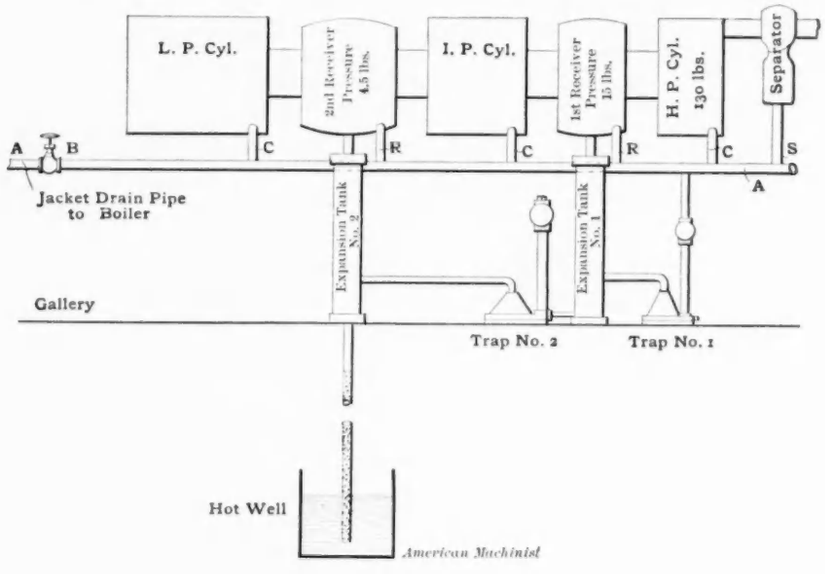
A New Method of Utilizing the Condensing Water from Cylinder Jackets.

Our illustration shows in outline a system of dealing with jacket water which is due to Mr. Richard J. Flinn, of West Roxbury, Mass. The system consists in taking the water of condensation from the jacket by trap No. 1, and instead of returning the same directly to the boiler, it is discharged into an expansion tank connected with the receiver placed between the high and intermediate pressure cylinders. The water being discharged into this tank at a temperature above that due to the pressure in the receiver, a portion of the water evaporates into steam and assists in driving the second cylinder. Trap No. 2 takes the water from tank No. 1 and discharges it into expansion tank No. 2, connected with the steam receiver between the intermediate and low pressure cylinders, where a portion of it evaporates and assists in driving the low pressure cylinder. The water from tank No. 2 is discharged into the hot well.

The water supplied to a boiler is the equivalent of the steam going out of it to the engine, and it is apparent that the steam required from the boiler to develop a given horse-power would be reduced by that obtained from the jacket water. At the same time the boiler loses the excess of heat in the jacket water above that due to atmospheric pressure which it would get if the water were discharged directly into the boiler, and the fuel account would not probably be reduced below that due to putting the jacket water directly back to the boiler. In other words in cases where the lay-out of the plant is such as to enable the water to be drained directly back to the boiler there is of course no gain in fuel due to this system, though there is a gain in water consumption, and where as is customary, engines are installed based on the water consumption the sustem gives an obvious advantage to the contractor. In cases where the water from the jackets is rejected to the sewer or run into an open hot well, so that its excess of heat above that due to the pressure of the atmosphere is lost, there is an obvious gain in the fuel account. Mr. Flinn has applied his trap to compound engine jackets in other ways. In one of these experiments trap No. 1 was discharged into the top of the low pressure jacket, the drain pipe of the low pressure jacket being connected with tank No. 2. The steam from the water discharged into the low pressure jacket was found sufficient to maintain a pressure of six pounds per square inch in that jacket.



A NEW METHOD OF UTILIZING THE CONDENSED WATER FROM CYLINDER JACKETS.

A New Loose Pulley Lubricator.

We illustrate herewith a very neat and certainly novel loose pulley lubricator. It employs grease for the lubricant, which is placed within the hollow cup clearly shown. The stub which is screwed into the pulley hub forms a piston to the cup, pressure on which forces the grease to the bearing. This pressure is applied through the bent and threaded lever having upon it a threaded weight. The centrifugal force of this weight, generated by the revolution of the pulley, is conveyed to the cup and forces the grease to the bearing surface. The threaded rod permits adjustment of the weight to or from the fulcrum, thereby regulating the pressure on the cup to suit the consistency of the grease or the speed of the pulley. It will be observed that the pressure ceases with the motion of the pulley only to be re-established as soon as the pulley is again put in motion.

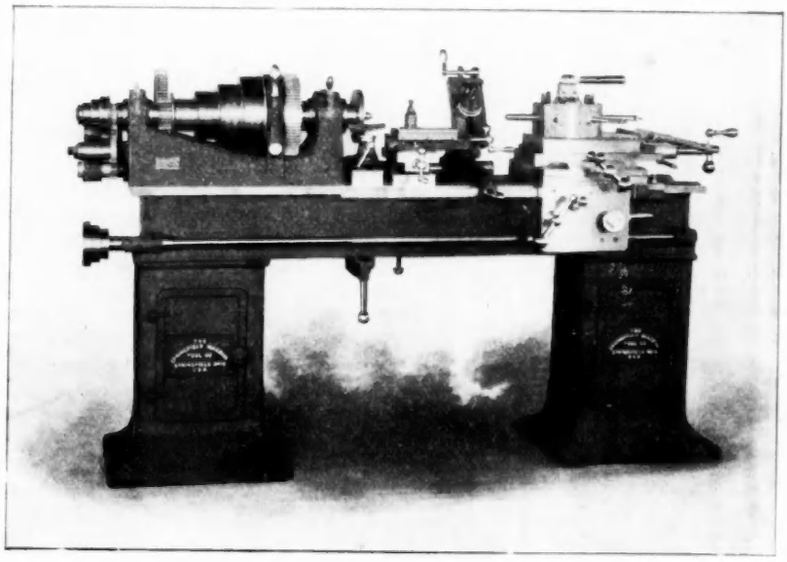
A NEW LOOSE PULLEY LUBRICATOR.

The lubricator is the invention of Mr. G. E. Davis, of Dubuque, Iowa.

A Brass Workers' Cabinet Lathe.

At the Elkhart shops of the Lake Shore & Michigan Southern Railroad they have recently installed a brass-workers' lathe that we think possesses some features of interest, and which are shown by the accompanying illustrations.

To begin with, it will be seen that the machine is very complete; in fact, we believe more so than any machine of its type previously constructed. It addition to the usual chasing bar, it has both T and compound rests, either of which can be quickly secured to the bed, as occasion may require, and the direction of rotation of the hob can be reversed so that both left and right hand threads can be chased without the necessity of providing both right and left hobs. The turret is mounted upon a carriage which somewhat resembles that of the ordinary lathe, and has a feed motion, which is reversible by the lever seen at the right of the apron. The turret is rotated, clamped and unclamped by the lever at the top, one motion withdrawing the locking pin and rotating the turret to bring the next tool into position; while a motion in the opposite direction clamps the turret, and only one hand is needed for this manipulation. The turret can be advanced either by a lever movement or by a screw, and the change from the one to the other is made instantly by clamping or unclamping the small lever seen below the larger one for working the slide. It will be noticed that, below the ordinary cross slide, is another one parallel to it, and this lower slide is connected to a taper bar, which is placed inside the bed, and can be set by suitable graduations to give any desired taper, the principle of this being the same as that of the Slate taper attachment; and by means of it not only can work of any desired taper be obtained, but work can always be faced square without resetting the machine.



CABINET TURRET LATHE.

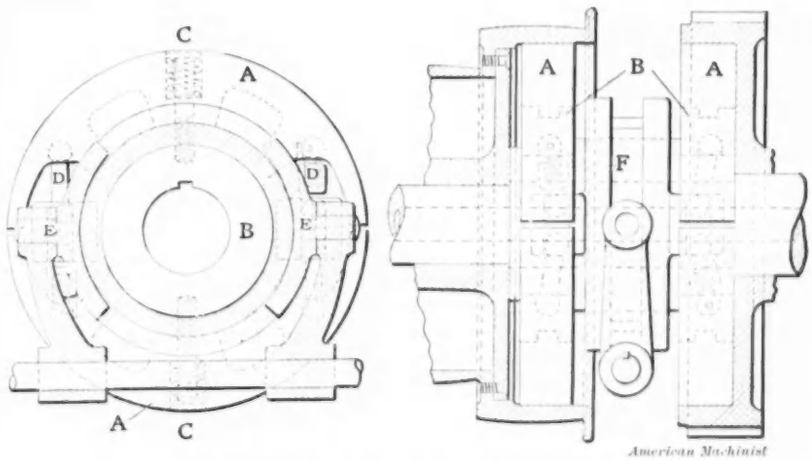
A feature of the machine which, we believe, has not been previously applied to tools of this class, is the clutch by which motion is changed from the direct driving to the back gears without stopping the machine. While such clutches are, of course, no longer new, they are, we believe, new in this class of tools, and the particular clutch used also has some new and interesting features, which are illustrated by the drawing Fig. 2. One difficulty with clutches of this class has been in the fact that either their original construction has been more or less out of balance, or that, as wear occurs, one or more parts of them are worn out of truth; and this, especially in a tool which is sometimes required to be driven at high speed, causes trouble. The present clutch is not only entirely symmetrical originally, but is so designed that it will wear evenly so long as it may continue in use.

The clutch-shoes *A A*, which, together, form what may be called expanding rings, are in halves, and are fitted with internal tongues projecting into grooves on the hubs *B*, which are keyed to the spindle. The shoes are held in position out of engagement by means of screws *C* and helical springs, which tend to pull them inwards. Each shoe is forced against the friction surface of either cone or face gear, by means of steel toggles *D*, with spherical ends. Between each pair of toggles a thrust piece *E* is placed, which is free to move laterally in its seat; so that there can be no unbalanced stress or uneven action, each shoe forming the abutment for the similar shoe opposite to it, so that the pressure brought upon them must be equal, without regard to questions of wear or possible maladjustment. In fact, only one member of each toggle is provided with adjustment, nothing further than this being necessary.

It will be noticed, also, that no part of the clutch is subject to distortion in action, and that the entire outer surface of the rings or shoes is made use of in such manner as to avoid unequal wear, and with no tendency to force either the pulley or any other part of the mechanism out of true.

For the purpose of adjustment for wear, it is only necessary to remove the guard, as the adjustable toggles are in an accessible position. The extreme movement of the ring *F* does not exceed ½ inch.

The machine is built by the Springfield Machine Tool Company, Springfield, O.



FRICTION CLUTCH OF CABINET LATHE.

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A Set Screw Kills a Man.

Thomas J. Daly was killed on November 1st at the Pearl street station of the Edison Electric Illuminating Company, in this city. He was not killed by electricity, but in the old-fashioned way, by getting caught by a revolving shaft. Daly had to look after the screw coal conveyor, and in oiling a bearing he leaned over the driving shaft, when a set-screw caught his clothing, and he was dragged over and crushed between the shaft and the conveyor.

The Forms of Field Magnets and Their Influence Upon the Efficiency of Generators and Motors.

BY WILLIAM BAXTER, JR.

The principles of operation of continuous-current electric machinery are so simple that anyone with a limited knowledge of electric magnetic actions can design a motor that will run; but whether the efficiency will be high or low, will be purely a matter of chance, if the designer is not thoroughly familiar with the fundamental principles of the subject. At the present time, when the conditions to be fulfilled to secure a good design are so well understood, it seems next to impossible to construct a machine that will not utilize a large percentage of the energy applied to it; but when we look back and remember that the best dynamos of twenty years ago failed to recover as much as 50 per cent. of the power applied to the shaft, we are forced to believe that it is possible to depart so far from correct proportions as to waste nearly all the energy. Perhaps there is no class of machinery that more thoroughly illustrates the truth of the saying, that there is but one step from the sublime to the ridiculous, than the electrical. If two motors were placed side by side, one of the highest efficiency and the other of the lowest, no one but an expert could point out the difference between them.

There are several ways in which energy is lost in an electrical machine, and although the sum total of all these losses can be made very small, it can also be made very large. Energy is lost in the wire wound upon the armature, and also in the armature core, the latter being caused by the constant shifting of the magnetic poles at a rate equal to the velocity of rotation, and also by the development of electric currents in every part of the core where a circuit is available, and several other actions that need not be enumerated here. There are also losses in the field magnets, due in part to the current required to magnetize them and to the development of currents in the pole pieces. There are several other losses, some of which are direct, and others that are caused by the reaction of one part of the apparatus upon another. It is not necessary to mention these here, as the object of this article is not to show the various ways in which energy is lost, but to point out the manner in which to reduce to a minimum one of the losses, that due to the defective design of the field magnets.

When an electric current is passed through an insulated wire wound around a bar of iron, the latter becomes magnetized. This action does not take place because the iron possesses the property of becoming a magnet when under the influence of an electric current, but because electric currents are surrounded by magnetism, and the iron, being placed in the magnetic path becomes magnetized; it is subject to a magnetic bath, so to speak. The ends of the bar become strongly polarized, and exhibit attractive properties, because iron is a material in which magnetic force can act with less resistance than in air, therefore the magnetism is concentrated in the bar. That portion of the bar that is covered with the wire will carry the total amount of magnetism developed by the electric current, but the projecting ends will not, and the relative proportion they will retain will depend upon their size and shape. If we conceive the bar to be bent into such a form that its ends are in the proper position for an armature to rotate between them, it is evident that it will then perform the office of a field magnet for a motor or generator. As the work done by the armature, either in the way of developing a twisting force in the case of a motor, or of generating a current in the case of a generator, will depend upon the magnetic strength of the ends of the bar between which it rotates, it is evident that the best form that can be given to the bar is that which will cause the greatest amount of magnetic force to remain in the iron up to the extreme ends. What this form should be can be easily understood from what follows.

The popular notion of a magnet is that it is a piece of steel that possesses the property of attracting pieces of iron to its ends, and of attracting or repelling another magnet, according to which end of the latter is presented to it. The metal is supposed to be the magnet, but, as a matter of fact, it is only the seat of a magnetic force, which is held captive by the steel in virtue of certain properties of the metal. A coil of insulated wire, as shown at *C*, in Fig. 1, will exhibit the attractive properties of a steel magnet, if an electric current is passed through it, and will continue so to act as long as the current flows. This is due to the fact that an electric current is surrounded by magnetic force, as already stated. Poles N and S, or points of attraction, are established as the ends of the coil, because here the magnetism is concentrated to a greater extent than at any other point outside of the coil, hence the force is the strongest at these points. Beyond *N* and *S* the magnetism spreads out as indicated by the curved lines, and fills the entire space surrounding the coil, and as the same amount of magnetism is expanded over a greater space, we might consider it as being in a more diluted form. The curves drawn to illustrate the distribution of the magnetism in the space around the coil are called "lines of force," as they represent the

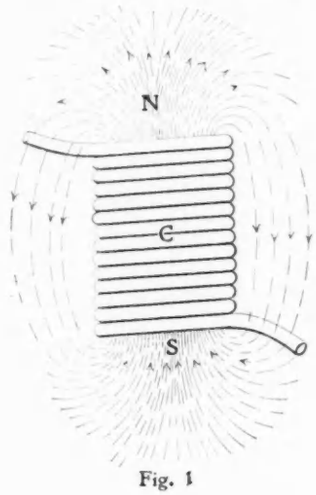

Fig. 1

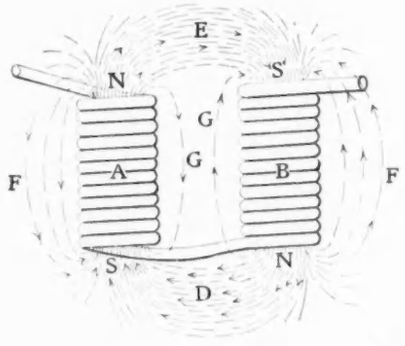

Fig. 2

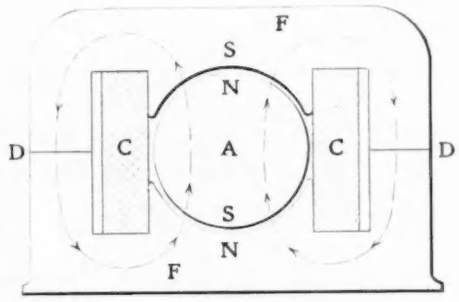

Fig. 3

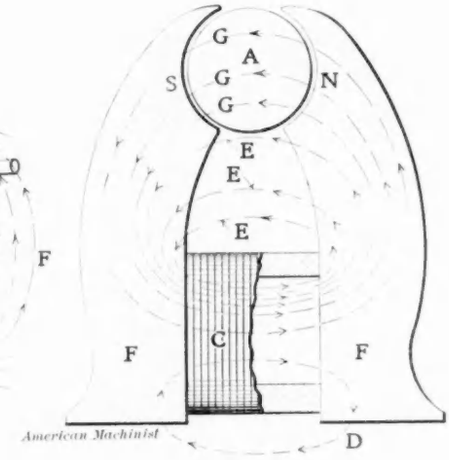

Fig. 4

FORMS OF FIELD MAGNETS AND THEIR INFLUENCE ON EFFICIENCY.

direction in which the magnetism acts, or what is termed the magnetic path, or circuit.

If the coil *C* is made much longer than shown in Fig. 1, and is bent over, and the turn where the bend is made is slightly unwound, so that the two halves may be placed side by side, as shown in Fig. 2, the path of the lines of force will be as indicated by the curves in this figure. The bending of the coil in the middle does not prevent the lines of force from following their natural path; those issuing from the lower end of the half *B* pass, as indicated at *D*, to the lower end of remaining half *A*. By the process of bending, the top and bottom of the coil have been brought closer together than in Fig. 1, and therefore the magnetism does not have to spread out over such a wide path in passing from one to the other, and on this account the magnetic force at *E* is stronger than at any point in Fig. 1 beyond *N* and *S*. The theory of magnetism is, that it acts in an endless path, and that the lines of force are endless curves; that such is the case can be more clearly realized from Fig. 2 than from Fig. 1; for, taking any particular curve and starting from the upper end of, say, side *A*, we can easily see that it can pass, without a break, through both parts of the coil back to the starting point.

All the lines of force issuing from one of the ends of the coil will not pass to the corresponding end of the opposite coil, but some will return to the other end of the coil from which they emerged; that is, all the lines issuing from the lower end of *B* will not follow the path *D* to lower end of *A*, and all the lines issuing from upper end of *A* will not follow the path *E* to upper end of *B*. Some of the lines will take the paths *F F*, and if the coils are not close together, other lines will pass between them, as indicated at *G G*.

As the effect produced by the armature is in direct proportion to the amount of magnetism, or number of lines of force that pass through it, it can be seen at once that the best location in a magnetic field developed by a single coil would be within the coil. Machines with the armature so located have been constructed, but the design has not been adopted by many builders, owing, perhaps, to the fact that the armature is not so accessible as in other forms that give substantially the same result. Fig. 3 shows how a machine can be made with the armature located within the field coil. The coil is shown in section at *C C*, and the armature at *A*. The field magnet *F F* forms a casing which entirely surrounds the coil and armature. This casing has openings at the ends through which the shaft projects. These openings can be made large or small, to suit the taste of the designer. As will be seen from the figure, all the lines of force must pass through the armature, except those that slip by between the surface of the armature and the inner sides of the coil. The field magnet in this case serves to provide an easy path for the lines of force outside of the coil. A modified form of this type of field is shown in Fig. 6.

If the resistance offered to the action of magnetic force by air and iron were the same, or nearly so, the design of Fig. 3 would be about the only one that could be used advantageously; but, owing to the fact that the resistance of iron is very much lower, it is possible to obtain magnetic fields outside of the coil that are very nearly as strong as that within. The magnetic resistance of iron is not constant, but increases as the density of magnetization increases—that is, as the force for a given section, say, 1 square inch, increases. For low degrees of magnetization, the resistance of iron is about one two-thousandth part that of air, and for the strongest magnetization used in motors and generators, about one three or four hundredth part that of air. It will thus be seen that even when the strongest magnetization is used, the resistance of iron is practically nothing compared with that of air, and, owing to this fact, it is possible to concentrate nearly all the lines of force issuing from a coil at an outside point, by simply shaping the field magnet with due regard to the properties of magnetism. To show how a magnet should be formed to concentrate the greatest amount of magnetism at a point external to the coil, we will consider Figs. 4 and 5, which are designed to concentrate the lines of force of a single coil, such as shown in Fig. 1. In both these figures *A* is the armature, *F F* the field magnet, and C the field coil. In Fig. 4, if the field magnet castings were removed, the number of lines of force passing through along the path *E* would be the same as those passing along *D;* but as the iron is a much better conductor, the presence of the field *F* causes nearly all the magnetism to follow the path above *C*. Some of the lines of force passing on this side will follow the paths *E E E E*, but the greater part will take the paths *G G G*, because, the armature being of iron, the only air interposed in the paths through it is that in the spaces between the surface of its core and the faces of the poles *N S* of the field magnet. The less the distance between the side of coil *C* and the armature, the fewer the lines of force that will cross the space, therefore the construction shown in Fig. 5 is better than that in Fig. 4. The form of Fig. 5 reduces the length of the magnetic circuit, and as the resistance is proportional to the length, even if the circuit is iron, it follows that, in consequence of this reduction of the resistance of the circuit through the armature, the number of lines of force that will pass by the path *D* will be reduced.

We thus see that by changing the form

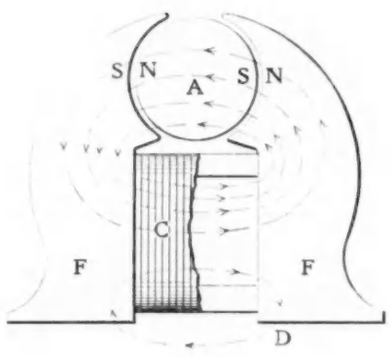

Fig. 5

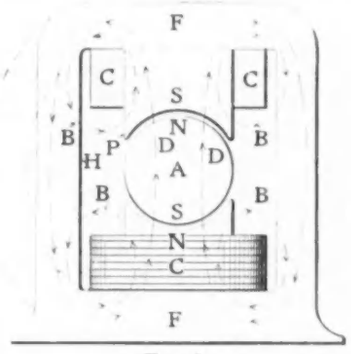

Fig. 6

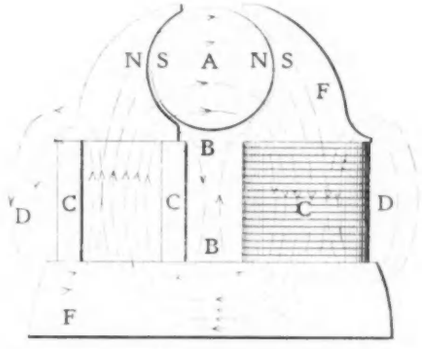

Fig. 7

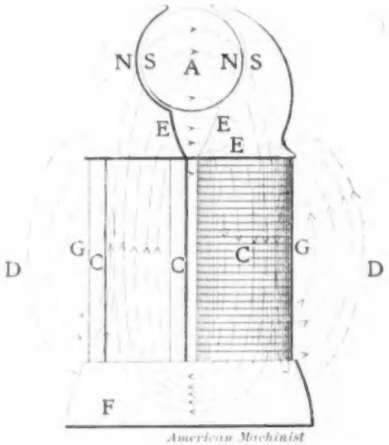

Fig. 8

FORMS OF FIELD MAGNETS AND THEIR INFLUENCE ON EFFICIENCY.

from Fig. 4 to Fig. 5, we not only get rid of the leakage *E E E* from one side of the magnet to the other, but also reduce the leakage by the path *D*. As shortening the circuit reduces the number of lines of force through *D*, it follows that the narrower the space between the face of the poles and the surface of the armature, called the air gap, the greater the percentage of the total magnetism passing through the armature.

Fig. 6, as already stated, is a modification of Fig. 3, the difference being that the coil is divided, the two halves being separated far enough for the armature to be slipped in from the end. Each half *C C* of the coil is virtually an independent coil, and therefore the lines of force will tend naturally to circulate around in the paths *B*. The greater the distance between the two coils, the greater the number of lines of force that will pass around each one independently. The path through the armature being more nearly all iron, will divert the greater part of the magnetism through it; but some will, nevertheless, flow along the paths *B*. If the distance between the side *P* of the poles and the side *H* of the outside part of the magnet is small, the resistance opposing the flow of magnetism in the paths *B* will be less than if it is great; therefore, the lines of force taking that route will be greater.

A consideration of the foregoing shows that to obtain the best results with this form of field, it is necessary to make the distance between the coils as short as passible, and to not bring the sides of the magnet too close to the ends of the poles. If the sides were swelled out, as shown in broken lines, the design would be improved, as the leakage along *B* would be less.

Figs. 7 and 8 show the form of fields required when two coils side by side are used, such as shown in Fig. 2. In Fig. 7 it will be seen that there are leakages along the lines *B B* and *D D*, and in Fig. 8 along *D D* and *E E E*. There is no leakage along lines *B* in Fig. 8, owing to the fact that the two coils are very close together; but in consequence of this closeness, the leakage along *E E E* is greater than it would be with the spacing used in Fig. 7. In this latter figure there is no leakage *E E*, because the armature is so close to the ends of the magnet coils that it is not possible for any lines of force to pass from one coil to the other without going through the armature. In both designs the leakage along *D D* can be reduced by reducing the air gap between the armature core and the faces of the poles. Fig. 7 is the best design, because in it the only leakage of any account is that along *D D*. That along *B B* is very small, because the proximity of the armature prevents the passage of any considerable number of lines of force by these paths. In Fig. 8 the leakage *E E* is much greater than *B* in Fig. 7, and D is also greater, owing to the fact that the greater length of the coils causes some of the lines to pass out before reaching the ends, as shown by curves *G G*.

Figs. 9 and 10 are forms that were extensively used in former days, and are still retained by some manufacturers; but they are not as desirable as Figs. 5 and 7, of which they are simply extensions. Looking at Fig. 9, it will be seen that if one of the coils, and the part of the field belonging to it, is removed, that it becomes Fig. 5; and in the same way, by removing two of the coils, on the right or left of Fig. 10, the remaining part, when stood upon end, will be Fig. 7. To obtain the best results with Fig. 9, the coils should be placed as close to the armature as possible, just as in Fig. 5. If the coils were extended sideways, as indicated by the broken lines *H*, there would be chance for leakage from top to bottom between the side *K* of the coil

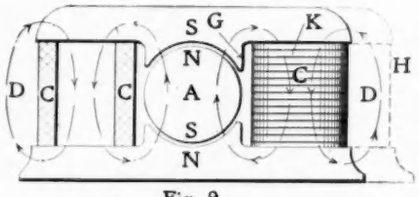

Fig. 9

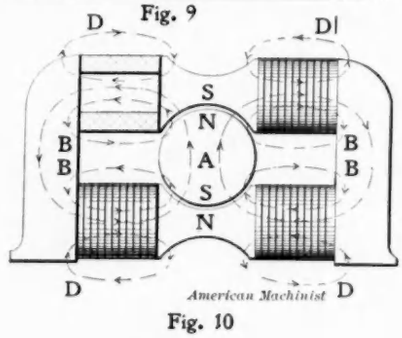

Fig. 10

and the armature, as explained in connection with Fig. 4. All that was said in reference to Figs 4 and 5 applies to Fig. 9, and, in the same way, all that was said about Figs. 7 and 8 applies to Fig. 10.

The reason why these last two figures are not as good as Figs. 5 and 7 is, that with them it requires more electric energy and more wire to magnetize the field. From the following this will be made quite clear:

The magnetism developed by a current of electricity circulating through a coil, is proportional to the number of turns of wire, and is not influenced by the diameter of the coil. If you have two iron cores, one 6 inches in diameter, and the other 1 foot, and wind on each one hundred turns of wire, a current passing through both will develop just as strong a magnetization in one as in the other; that is, the lines of force per square inch of cross section will be the same in both. This is true, providing the circuits in which the lines of force are developed are of equal resistance, and practically they would be, as the large magnet would only have an increased length of iron part of the circuit, and this would add only a trifle to the total resistance. If the lines of force per inch of cross section are equal in both cores, as the large one has four times the area of the small one, its total magnetism will be four times as great; but the length of wire required to make one hundred turns around the large core would be twice as great as for the small one; therefore, four times the magnetic force would be obtained with double the wire and double the electric energy. For the foregoing reasons it is best to use only one path for the magnetism from pole to pole. In early days this fact was not understood, and machines were made with several sets of coils, in the belief that better results would be obtained thereby.

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A Novel Hydraulic Air Compressor.

A recently patented air compressor consists of an endless chain of buckets working up and down in a vertical column of water. The hight of the column of water determines the pressure of the air. The buckets enter the water upside down and empty, or full of air only. As they descend the air is compressed and when the buckets turn to ascend the air escapes upward and is immediately caught in a suitably placed chamber from which it is conveyed by a pipe for use. The buckets ascend full of water, and as they turn to descend again the water is all poured out. No valves or other mechanism are required. The apparatus would seem to be a practical one for limited pressures. For the usual working pressures of, say, 75 pounds a hight of nearly 200 feet for the water column would be required. This might be all above ground, or all below ground, or otherwise as most convenient. For blowing purposes of course no great hight would be required.

▲ ▲ ▲

The so-called "Fair" of the American Institute, recently held in this city, came to an end without excitement. It is to be hoped we may never see another like it. As an exhibition of "American art and industry," it is too much like obtaining money by false pretences.

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We have recently received a letter from Mr. Adolphe Janssen, of Paris, in which he mentions the fact that within the past six months he has received orders from the French Government amounting to $150,000, and comprising 44 lathes, Flather, Prentice, Bullard, Springfield, Hendey and Pond make; 15 planers, Flather, Pond and other makes; 10 slab millers, Ingersoll, Brainard, Newton, Beaman & Smith makes; 16 presses and 9 miscellaneous tools, Cincinnati, Warner & Swasey, Newark, Bement, Miles & Co., Becker and Hurlbut.

Hints About Iron.

BY B. F. SPALDING.

DIFFERENT HEATS—STIFF WHITE HEATS —BENDING ELASTIC AND INELASTIC PIECES — COLD-SHORT IRON — INTRODUCTION TO RED-SHORT—GOOD BUT UNPROFITABLE IRON — TESTS FOR IRON.

Not steel, not anything else, can take the place of good wrought iron well case-hardened. It is for some purposes the best material in existence. Steel can never take its place, and hence the art of making good wrought iron should be fostered with wise and intelligent persistence. If you shove a bar of iron through an ordinary forge fire and let it stay there, with the fire burning, the part that is in the fire will, after a while, get white-hot; the ends outside the fire will remain uncolored by the heat, or close up to the fire, perhaps, they may darken in the shade of the scale and be what is called "black-hot," while for a longer or shorter distance there will be a space on each side between the white heat and the black, which will suit anybody's notion of a red-heat.

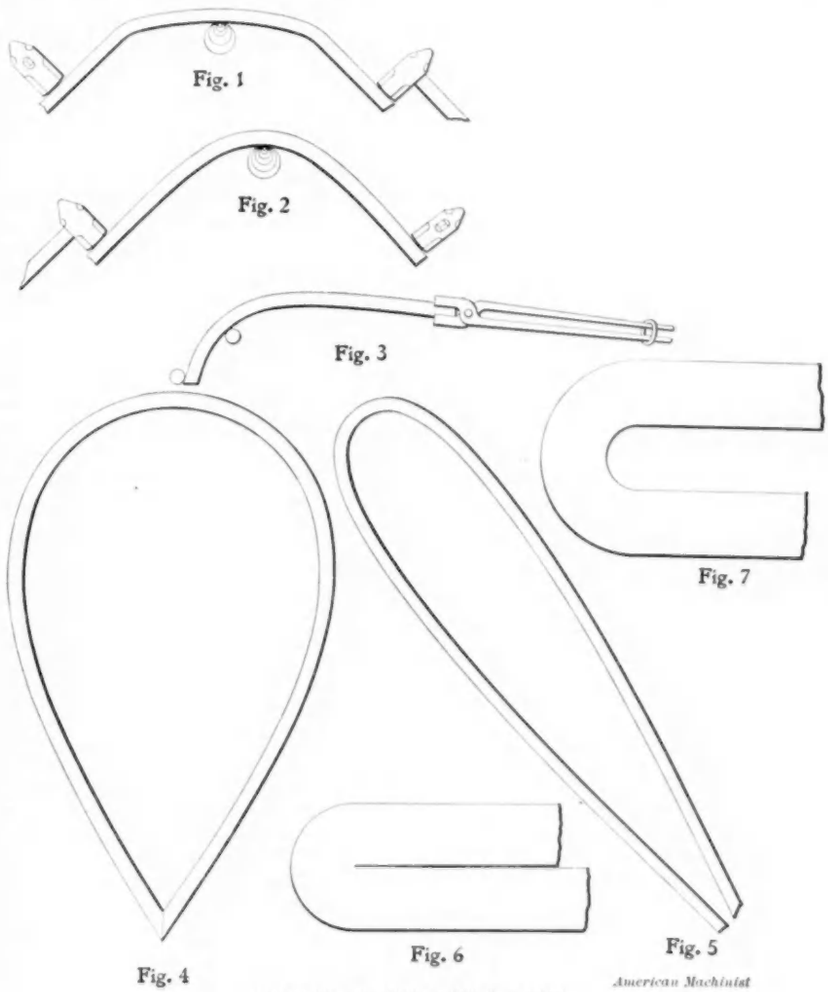
There is a peculiarity about some iron which I have often observed with curiosity, but which I do not remember to have seen mentioned. If a bar of this iron is heated for some distance in the length of it to a uniform white heat, it appears to be stiffer in that portion than it is at the lower temperature, the red-hot part, which intervenes between the cold ends and the white-hot part. This peculiarity of being less readily bent where it is the hottest is shown when an attempt is made to bend it by letting the middle rest against something, as, for instance, the horn of the anvil, while each end is pressed in a direction to bend the bar. The bar will then have a greater bend at the places where it is red than along the part where it is white, as shown in Fig. 1. This behavior appears singular when it is considered that a piece of uniform resistance, if stressed in this manner, would bend as shown in Fig. 2. If a piece is resisted, as in Fig. 3, at *A* and *B*, and pressure made on the end, it will take the form of the piece represented. The resistance *A* is substituted for the pressure made on one end of the bar in Fig. 2, and the form of the bend is as one-half of that in Fig. 2. The mode and amount of resistance is best shown by the flexion of an elastic piece of uniform section. Fig. 4 represents such a piece bent until the ends meet. It is sufficiently definite and comprehensible, probably, to say that the leverage increases from each end to the center, causing the greatest stress to concentrate there, as is shown by the shape of the piece strained. A bicycle spoke, when bent, assumed the shape of Fig. 5, because it took a permanent set in the center at less stress than was required to bow out the sides, like the more elastic piece shown in Fig. 4.

As the piece of iron heated white hot in the middle did not bend the most there, but at the end of the white-hot portion, it is evident that it was not only as stiff as the red part, but also so much stiffer as to increase its resistance in a greater proportion than the increase of pressure in the center due to the leverage.

There may be a theory assigned for the bending as shown in Fig. 1 which would suppose that there might be in the iron some constituent, simple or compound, which at the red heat is in such a condition that it forms a lubricant on which, or in which, the particles can move with extraordinary freedom; and above that heat it is in a gaseous state too attenuated to lubricate, and below that heat it is in too solid a condition to facilitate flow. This theory, when examined and expanded, will also afford explanation for other phenomena.

But theory is only valuable for its practical bearing, and, without regard to any theory whatever, blacksmiths intuitively endeavor to ascertain the heat, by its color indications, at which the particular brand of iron or steel they have in hand will work the best. There is, however, a very discouraging thing about these investigations, and that is that often when considerable studious and laborious effort has been made to determine and use the particular temperature adapted to work a cheap metal which fails to work well at ordinary temperatures, it will be found to be so irregular and unreliable that all this well-meant effort proves to be wasted, and yields nothing but disappointment and thorough dissatisfaction.

Iron is iron, and steel is steel; but there is iron and iron, with a distinction and a difference, and so there is steel and steel. It is hard to make some people comprehend this. There are still some people in business who do not realize the vital facts. It is not, perhaps, as bad as it used to be. It is said that an ironmaster once presented himself at the works of an establishment where the blacksmith had complained about having poor iron. He got the head of the concern to go with him to the blacksmith shop, and blustering up to the blacksmith, said: "I hear you are making complaint about poor iron. Now, show it to me. Come, I can't stay here all day for you! Just show us this poor iron you're making so much fuss about." The scared smithy brought him some pieces of 1⅛-inch round iron,



HOW IRON AND STEEL BEND.

with sand, solid sand, seams ⅛-inch wide, running clear to the center. The ironmaster eyed them with contemptuous severity. "Huh!" he snorted, just as I thought—nothing at all the matter with that iron, only—it's a little too rich in silicon!" His lordly assumption was so adapted to the taste of the proprietor that he was charmed with it, and gave his workman a chilling glance that congealed the marrow in his bones, and set him down as a fellow who was no judge of iron. Which notion, it might be expected, would have proved in the long run to be an expensive luxury; but it occurred to him, when the glamour of enchantment wore away, that where the sand was the iron was not, and he could not exactly comprehend how this richness in silicon added to his real estate or other riches, except as a minus quantity.

One would not suppose that it would be very difficult to convince an interested party that the iron is bad when such gross defects are plainly to be seen; but iron is subject to defects which are not so palpable as sand bars. It may be cold-short or red-short. There is not much trouble in convincing anyone of the imprudence of having anything to do with cold-short iron. It may have considerable tensile strength, but it is treacherous. It lacks toughness, and is peculiarly liable to fracture from shock, especially when under tension or compression. No factor of safety can be set for it. It is safe in no determinate degree.

Red-short and hot- short are sometimes distinguished from each other as distinct terms of diverse signification. By red-short iron is understood a kind of iron which is most easily fractured at the heat already described as being between black-hot and white-hot. It was my good fortune to have worked at my trade some ten years before it came in my way to make the personal acquaintance of red-short iron. My work had been on guns, gun tools and gun machinery, and had required the use of steel or the best of iron. But my time came. I had just commenced work in a strange shop where once were the happy hunting grounds of Uncas, the Mohegan brave. They made everything in that shop; their real business was to make money. I had hardly got my fire started in the morning, when the superintendent came tearing in and wanted "a piece of ½-inch round iron, bent so (gesture) about a foot from the end, and then a piece of it, about 8 inches long, bent up this way (gesture), and then about 15 inches run off so" (gesture). He accompanied his oral description with ample graphic delineations in the blue smoke. Of course I understood these aboriginal blueprints—what was I there for? I took a piece of iron I thought would be long enough, gave it a little heat in a great hurry, cooled it in the trough up to each side of where I wanted the bend, gave it a flip with my hands to bend it, and lo! it broke short off. "What's the matter?" said the impatient superintendent. "Crack!" said I. I took another piece and heated that, and it did the same thing. "What's the matter with this iron?" he roared to the blacksmith at the next forge. "Nothing that I know of," said he. "I never had no trouble with it." The wretch! the prevaricator!! I saw at once by the furtive glance of his eye that he thought he had me caught. Why didn't he tell me? He could have nothing against me, for I was a stranger to him. The moment I caught that glance, though, I knew I had struck the kind of iron I had read about, and I laughed good naturedly, and in a few moments I had the boss' iron ready for him all right, without a flaw. "What was the matter with those other pieces of iron?" he asked, and I replied, "Red-short." He probably did not know that the piece he carried off was of just the same quality, but a little differently treated. After the boss went out, I asked my fellow-workman why he didn't tell me the iron was red-short, and he said he knew I would find it out. "I've been trying to make the company know what kind of iron they were getting, but they didn't take any stock in what I told 'em, and I thought I could stand it if they could, so I was kinder glad to have the boss get a chance to see for himself." I reckoned that it was human nature that made him prefer to see the iron fail in my hand, rather than in his, and I didn't blame him for it. But the iron did not get any better. It was good iron, only it was red-short, and it could be worked safely at the proper heat.

Some years after this I had a different experience with iron which would not bend safely at any heat. And yet almost any rod of this iron, five-eighths round, could be bent over cold and hammered down close folded upon itself, as in Fig. 6. A piece of iron is said to be bent double when it is closed within a distance equal to its thickness, as in Fig. 7. It must be confessed that iron which is so tenacious that it will stand this test without breaking, lays claim to the possession of excellent qualities. But if it is impossible to work it (without a loss of more than 25 per cent) into the shape in which it is to be used, it is subject at once to a depreciation of 25 per cent in value, and whatever more of cost may have been put upon the 25 per cent. of pieces which are lost. This was good iron when it was cold, but it was unprofitable because it was very bad iron when it was hot.

Every artifice which could be imagined was resorted to in the attempt to work this iron with less loss. Every different heat was tried and different kinds of fuel—soft coal, hard coal and coke—with but little, if any, difference in the results. The attention of the iron maker was called to it, and he stood by and saw it worked, and could not suggest any improvement. Of course, it was not his business to know how to work the iron; but it was his business to know how to make iron that could be worked, or he should have had somebody about his place who had some inkling of this special function of the ironmaster. When he was asked what defect the iron had, he said it was "too rich."

Too rich! That might be understood as meaning that the iron makers were using so much of some particularly high-priced and valuable material in the manufacture of iron as to injure its quality. That may appear absurd at the first thought, but, nevertheless, such a thing might easily be. But with one statement which he made I could not entirely accord. He said that the iron was red-short. Strictly speaking, the term was hardly appropriate, because red-short iron should bend at a white heat without cracking, and this iron did not. No more pieces of this iron would bend at a white heat without cracking than at a red heat. It was not uniform, and as its defective working was not amenable to any one remedy at the blacksmith's command, so it was not due to any one cause under the blacksmith's control.

It is said that the presence of sulphur is the occasion of red-short iron, and that manganese is its antidote. The same thing is said in regard to steel, and it is also claimed that manganese is an antidote for occluded oxygen in steel. Referring to the theory already mentioned in connection with the bending of iron, it may be that the presence of manganese in combination with the sulphur which causes red-shortness, or the oxygen which causes all-shortness, might remedy all defect by lubricating the movement of particles and facilitating flow. If the defective working of this iron could have been improved by this one remedy, the only place where it could have been applied was in fusion where the iron was made. This is not mentioned in advocacy or endorsement of a theory, but simply to illustrate the statement that whatever is to be done to iron to make it good should be incorporated in its constitution. The day was when the blacksmith worked his iron from larger to smaller sizes, and made it good, if he could; but that day is so long ago that few are alive who remember it. I can remember, in 1852, an old friend of mine, an armory blacksmith, Mr. Fowler, over seventy years old, saying to me, "We always used to take a good welding heat on our iron before we brought it out on the anvil, and the first thing we did was to weld it up sound; but you don't do it now." I replied, "No, we don't have to; it comes to us sound from the makers. It is their business to make the iron." To my knowledge, it has been the wise and economical custom, in some places for half a century, to procure proper sized iron from the makers, and the blacksmith has had nothing to do but to shape it, often without altering its dimensions.

The great desire to get cheap iron should not obscure the fact that cheap iron may waste so much in working as to make it unprofitable. Now, while prices are low, is the proper time to get better iron for the same money. There are certain qualities required in iron for any use, and when these things are duly specified, the blacksmith should be depended upon, and held responsible for the specifications being duly fulfilled. A working test specified by an American railroad, requires that "a ¾-inch round bar shall bend double cold and show no fracture; the same bar heated, to be bent and also to be drawn to a point showing no tendency to red-shortness."

But red-short iron need not be barred out; nor need any iron that is tough when it is cold, if it is only regular, and can be depended upon to work with safety at any certain heat. A blacksmith need not lose his iron if he can be certain that it will work at any particular heat, for with preparation he can get one heat as well as another.

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Letters from Practical Men.

The Heilman Locomotive.

Editor American Machinist:

Mr. Swift, in his article on the above subject, gave me something to think about. Who can tell me what Mr. Swift was driving at? Is that locomotive a good one or a bad one; is the idea foolish or wise, and what is the meaning of all Mr. Swift had to say? is what I would like to know.

What I have been reading about the Heilman locomotive gave me the impression that this engine was built with the idea of economy, not with the purpose of having a perfectly balanced locomotive. As is well known, the locomotive is about the most wasteful steam engine ever invented, and no one is to blame for it. The conditions under which the steam creates the motive power are extremely unfavorable. If the locomotive were a stationary engine, it would be able to develop the same horse-power with one-fifth of the coal, and do nothing very wonderful even then. Now, I understand that this is Heilman's idea: Suppose it takes 300 horse-power to run the train, and suppose, further, that here is a loss of 50 per cent. between the Willans engine and the driving axle of the locomotive (which is a much bigger figure than is necessary with such a short conductor), then the Willans engine must develop 600 horse-power.

Assuming that the stationary engine is three times as economical as a locomotive, there is a gain of 33 per cent. over the coal consumption of the locomotive. My figures are arbitrarily chosen, and serve simply to illustrate my conception of the Heilman idea. The gain may be more, or it may be less, or perhaps there is none at all; but in any case, I fail to see the foolishness of the idea. But maybe Mr. Swift did not mean to say at all that the idea is a foolish one; maybe he wanted to say exactly what I have said; maybe he did say so—I simply failed to understand what he was driving at, and as there may be others in the same fix as I am, I thought a few lines on this subject would not do much harm.

If I am allowed to moralize, I would like to say there is no scheme better than the one which gives the required result, however foolish it may look to the unaccustomed eye.

A. L. DELEEUW.

Hamilton, O.

Editor American Machinist:

The above letter has been rather slow in getting to my notice. The writer simply needs to read my letter, as he does not seem to have done so yet. If in the Heilman locomotive the Willans engine had been applied directly to the driving of the vehicle, my criticism would have been impertinent; but as the engine drove an electric generator, the generator drove a motor and the motor drove the machine, why would it not have been vastly better to have dispensed with both the engine and generator, and to have taken the current from the line by an overhead or an underground trolley or some equivalent device. I believe that there is still great possibility of improving the locomotive, but not because it is "about the most wasteful engine ever invented," as that fact is only "well known" to those who do not know correctly. I spoke of the balance of the working parts of the Heilman locomotive, because I wanted to say all the good that I could of it.

TECUMSEH SWIFT.

Editor American Machinist:

It seems to me that Tecumseh Swift, in his article on the Heilman locomotive, is looking on only one side of the question. Of course, no one will deny that in every change of power from one form to another there will be some loss, but there may be gain in another direction which will more than make up for it. The Patton electric motor is similar in principle to the Heilman locomotive, except that a gasoline engine is used in place of steam, and a storage battery is used, so that the engine may run continuously and always keep surplus power in reserve. This makes it possible to use a small engine, which will store power when the car is stopped, and on grades get power far beyond the capacity of the engine. If this same principle was applied to an air motor, the engine could be quite small, and be controlled by a governor, so as to require almost no attention. In street-car service, where stops are frequent, the highest pressure would always be available for starting, which is a very necessary qualification. The same water which cools the engine and compressor cylinders would be used to reheat the air in the working cylinders, and thus kill two birds with one stone. I also believe that this is the ultimate solution of the horseless-carriage problem—a small engine, taking care of itself and driving a compressor, a storage reservoir and a simple air engine which would be perfectly under the control of the operator. In using a gasoline engine, the storage feature and having the driving mechanism under perfect control would, in my mind, far outweigh the losses in the various transmissions.

JUNIOR.

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Lubricating Crank Pins and Bearings.

Editor American Machinist:

I have recently had experience, in a practical way, with the friction of engine journals, and I want to give the results to your readers. On examining under a magnifying glass the finished surfaces of a locomotive crosshead gib and guide, both in profile, I was surprised to find they showed surfaces similar to the face of a coarse bastard file as seen with the naked eye. I could at once understand why new guides and crossheads, or any other bearings, ran hot unless well supplied with an appropriate lubricant. By this I mean a lubricant capable of keeping the toothed surfaces of the bearings from coming in actual contact, so that the teeth would not interlock, and, like a file, abrade the softer of the two. I readily saw that the oil or lubricant must be heavy enough or thick enough to float the two surfaces sufficiently far apart to allow the teeth of the crosshead bearing to float over and clear of the tops of the teeth of the guide surface. This clearly involved the surface and weight which the crosshead bearing presented to the guide.

If a pail of water and a pail of mortar be placed side by side, and a brick is placed in the water pail, it at once sinks to the bottom. But if it be placed in the pail of mortar, it remains on its surface. Yet both the water and mortar are, in a practical sense, fluids; but one is too thin to support a brick, and the other, because of its thickness or body, readily holds it up. This fact being understood, I readily saw that an oil must be adapted in its body or thickness, or ability to resist being squeezed out of the way by the weight or pressure on the two bearing surfaces tending to force them together. In an exaggerated way, suppose the bearing surface of a locomotive guide to be faced with bastard files, like gibs, and the bearing surface of the crosshead to be similarly faced with files. Now, it is clear that if we can introduce a fluid of a sufficient density to prevent its being squeezed out from between the surfaces, that our file crosshead and file guide will work all right, so long as the lubricant

prevents the teeth of the crosshead files from engaging and contacting with those of the guide's file surface. But with surfaces like files, it is plain that no lubricant exists which will act as a lubricant and at the same time withstand the pressure of a heavy bearing. It is clear, therefore, that the smaller we can make the file teeth of our bearings, the thinner will be the lubricant necessary to float the bearing's teeth apart. Yet all bearings I am acquainted with appear to possess these inequalities of surface, which inequalities require a separating medium capable of sustaining the weight or pressure forcing the surfaces together, and yet fluid of itself.

It occurred to me that if the rough file-appearing teeth of bearings could be riveted down by a burnishing process, it would help matters, and I found in practice that by using a hardened-faced roller as a planer tool (and as a lathe tool on crank pins, driving axles, etc.), in lieu of emery, files, etc., that I secured a dead-true and dull appearing surface which resulted in an entire absence of any heating troubles, in new engines, or all surfaces so treated. In other words, the burnishing of a bearing surface bends over and crushes down the microscopic teeth of a bearing as left by any common commercial method of cutting and finishing such bearing surfaces. Suppose we, by heavy pressure (if the teeth would allow of it in a file), were to roll or crush down, or turn or bend over and down, the teeth of our assumed file bearing. We would in this case at once have made it possible to use a much thinner lubricant, since it would not be necessary to float the surfaces of the bearings so far apart—that is, by reducing the hight of the irregularities of our bearings by burnishing, we may allow of the two surfaces coming closer together without the interlocking of the projections, and therefore a thinner lubricant may be used. Yet there would still remain some irregularities (microscopically speaking) after the burnishing of the surfaces, and one might be inclined to use flake plumbago to fill up the low places in the bearing surfaces, and this I tried on a consolodated engine main-crank pin, 6 inches in diameter. Contrary to my expectation, the bearing heated promptly. I found that the flake plumbago separated from the oil and, because of its weight, settled at the bottom of the bearing, until it had filled all the open space or lost motion of that bearing. As more oil and plumbago came from the cup, the latter kept on packing itself, until the brasses were wedged and bound onto the pin, thus causing the heating by pinching the journal.

Knowing that white lead had little tendency to separate from oil, I tried a heavy valve oil with about 15 per cent. of keg white lead mixed with it. I was surprised at the good results obtained, and I can recommend, as the best possible lubricant for all locomotive bearings, a heavy engine oil with 10 to 15 per cent. of keg white lead mixed with it. For air pumps it is unsurpassed, and for sight-feed cylinder lubricators, an engineer who once uses it mixed with valve oil will never bother with anything else. Plumbago I find specially objectionable in any oil cup where, for want of movement of the part to which the cup is attached, it quickly settles to the bottom in a thick, hard cake. White lead, on the contrary, stays mixed, and has all the body necessary to fill up the depressions in a bearing.

A. J. RENWERK.

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The Emery Wheel Its Own Exhaust Fan.

Editor American Machinist:

In the issue of September 30th, sketches were shown to illustrate the fact that the emery wheel can be made its own exhaust fan, with the statement that it remained for Mr. Wm. Taylor, of Leeds, England, to turn this to good account.

On page 64 of the 1897 edition of the Brown & Sharpe Manufacturing Company's catalog will be found a cut and a brief description of a "polishing wheel stand, of such shape that the draught caused by the rapid movement of the wheel carries the larger part of the dust produced by grinding from the operator to the bottom of the stand." This machine has been shown in the Brown & Sharpe Manufacturing Company's catalog, beginning with the 1891 edition, and these stands are in use in various places. It may be of interest if I here explain this machine and show how it is arranged to make the wheel its own exhaust fan.

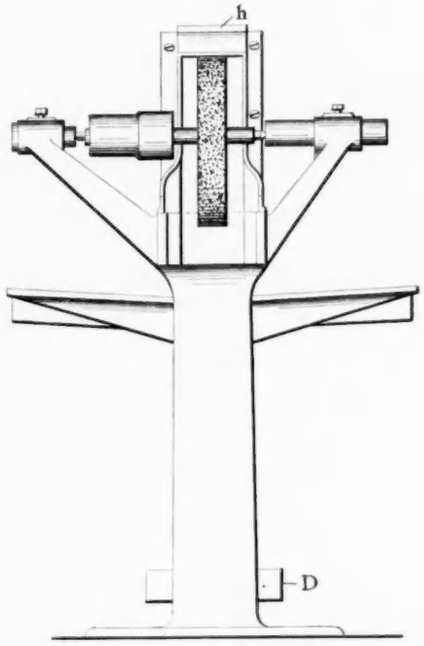

Fig. 1

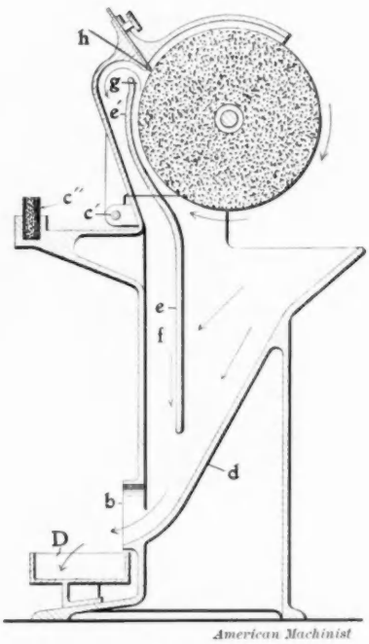

Fig. 2

The figures show the machine in section and elevation. The operator sits in front, with feet on the iron base and knees on either side of the column. The shelves and receptacles on either side are for boxes of work, and to hold waste, oil can, pumice stone, oil stone and other things needed by the polisher. Attached to the rear of the right-hand upright is a small shelf to hold the wrench used for clamping the wood bearing pieces, as the spindles run on the usual polishing wheel points. Attached to the rear of the column are hooks on which to hang extra arbors.

The movements of the air currents may be understood by a study of Fig. 1. In this case the work is held in front, or a little under the wheel. (To grind on the top or front, with the wheel running up and over, the arrangement is different, but on the same principle.) With the wheel running in the direction of the arrow, air and dust follow the direction of arrows, most of it going down. But those familiar with polishing know that a large number of sparks will follow the wheel clear around, while others leave the wheel at nearly all points, and when the wheel is covered with a guard, the dust will be brought around to the operator.

This stand is cast hollow, with a partition *d* to guide the air currents to the outlet *b*. There is also another partition *e* to guide the air currents toward the outlet. These currents, passing the opening from the passage *f* on their way out at *b*, cause a draft down the passage *f*. Planed to fit the top of this stand or base is a wheel cover, or guard, that has in it a partition *e'*, which coincides with the partition *e*, forming a continuous passage. This partition ends at a point above the center of the wheel, and there is a passage

into an enlarged space, shown by the curved arrow. Now, as air is being thrown from the wheel, it most naturally seeks the opening *g;* that is, it is confined between the wheel and the partition, and when it reaches the opening, it "seeks the path of the least resistance" and pours into the enlarged space, the curvature of which serves to direct its course downward. This, with the draft caused by the movement of the air from the front of the wheel past the lower end of this downward passage, causes the currents to continue on out of the passage *b*, depositing the dust and dirt in the box *D*.

Experience has shown that when the dust has reached this box, it falls gently and does not rise again. This is accomplished by the arrangement of passages, which allow a gentle flow of air—enough to prevent dust from rising from the work and wheel, but not sufficient to disturb the dust, which has reached the lower surface of the passage *b* and the box *D*. To further insure the passage of all dust from the wheel to the passage *g*, there is a sheet-steel gate or slide *h*, which is adjusted to just touch the periphery of the wheel, thus practically stripping all air and sparks from the wheel. The wheel cover is hinged at *c'*, and swings over, resting upon the rubber cushion *c"*, when it is desirable to change wheels.

When precious metals are polished, a tank of water can be placed under the outlet *D*, and all waste recovered. In all cases the outlet *D* can be simply connected to the open air in any way, so that the wind cannot blow in, and a hand hole arranged to remove the dirt from the pipe at and near the passage *b*.

When an exhaust system is handy, it can be connected to the outlet *b* to remove the dust as fast as it is delivered to that point by the wheel currents, and thus make the cleaning of the pipe automatic; but it has been found that so far as exhausting the dust from the air around the wheel, and to prevent this dust from rising or moving about the room, this arrangement is successful even though it has no connection with an exhaust fan.

When grinding on the side of the wheel, this arrangement takes care of the dust equally well. A glance at Fig. 2 will show that sufficient space is provided for the small amount; the flow of particles will be widened as they leave the work and wheel. All currents of air leaving the wheel at and after the point where the grinding is done, must enter the base whether the grinding be done on the periphery or the side of the wheel, and it is only necessary to provide an opening large enough to admit any stray particles that have been deflected from their natural course by adhering to the corners of the work or by the eddy currents behind the work and hand of the operator.

C. H. NORTON.

Providence, R. I.

Single Line Manufacturing.

Editor American Machinist :

A machinist asked a librarian for the name of some book upon "milling machines," and at his next visit to the library, was handed a long list of books upon the milling of grain into flour for food. He thanked the librarian and took to himself the blame of not stating more definitely that he had meant the milling that is practiced in a machine shop. In a broad sense we might consider the sub-division of grain and the sub-division of metals as belonging to the same "line," though they would usually be thought distinct. A concern might make a barber clipper and an automatic gear cutting machine—while both these tools are for cutting, yet hair cutting and gear cutting require different lines.

In your isue of October 28th, Mr. C. O. Griffin distinguishes between one concern that will design and make a machine to order, and another concern that designs and manufactures only such machines as are to be a regular product. His distinction is perfectly legitimate, but it is not the one referred to in your issue of October 7th.

What I wished to urge might be illustrated by saying that milling machines manufactured by a concern that puts out several other kinds of machines are not necessarily inferior to milling machines manufactured by a concern that puts out nothing else.

A CASUAL OBSERVER.

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English versus American Lathes.

Editor American Machinist:

While we are on the subject of lathes, I would like some of your correspondents to give the devil his due, and try and grasp the reasons and ideas of an English lathe. "Australian" is right in many respects, and so are the exponents of American lathes; although they will not allow a point to the English style. Take the tool post, for instance, the American single screw post, with leveling or adjusting wedge for hight of cutting edge of tool (the principal advantage claimed), admitted that it does allow of this adjustment; but what is the use of having a tool grinder to get the correct cutting and clearance angles if we go and deliberately alter these angles when we put the tool in the tool posts. Again, it is impossible to get the tool close up to the work in boring, isn't it? It seems to me that none of your correspondents have seen any but the four screw tool holder on English lathes. "There are others." I have in mind one where either one or two screws could be used, and whichever way it was used, you could get close up to the work. When I say close, I mean close, and not near; that is, the bottom of the tool could rest ⅛ inch back of the cutting edge. The clamp could be put into any position, the same as with the American tool post.

As to that gap, that very much abused gap, it has its uses, and good ones, too, either in the jobbing shop or in the well equipped factory. We have an eccentric 13 inches diameter for 2-inch travel, to fit a 3½-inch shaft; this will swing 15 inches, therefore it must be put into a 16-inch swing lathe to bore a 3½-inch hole, whereas a 10-inch lathe with gap bed would easily do the same thing, and let the big tool do work of its size. There are hundreds of similar jobs where a tool representing thousands of dollars is used, when it could be done on a tool worth only as many hundreds. The two-spindle lathe, made to try and get over the gap (similar to compensators to get over the fly-wheel), has its points, but you have to change the rest, chuck and gear, while in the gap lathe you only take out the bridge in the gap. On the other hand, you can turn a longer piece, which you cannot do in the gap lathe. As to the compound rest, it is a most useful attachment, especially for the jobber and amateur. As to amateur foot lathes, I have not seen one in America to compare with the English for usefulness.

ERNEST W. NAYLOR.

Philadelphia.

[The above letter will probably be of interest to our readers. We cannot, of course, endorse all its assumptions. For instance, the ability to raise or lower the tool affords a ready means of securing the correct adjustment of the cutting angles, rather than of defeating that adjustment. Supposing a tool to be cutting correctly, and after a while to need regrinding. It may be necessary, especially in the case of a diamond point to grind off the top. Common-sense would seem to suggest that in resetting the tool, it would be proper to have the cutting edge as high as before, which could not be done without raising the shank of the tool, or at least tipping it up in front. We are not purposely arguing for or against either the American or the English tool, and are only anxious to bring out the best points and the advantages of each, which should be expected to be done by those most familiar with them. It should be borne in mind that tipping the end of a lathe tool up or down may be simply a means of maintaining the same cutting angles, instead of changing them.—Ed.]

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Quick-Acting Dog.

Editor American Machinist:

In your issue of October 22d, I notice that Mr. G. R. G. Wren, of Philadelphia, has recently patented a quick-acting lathe dog.

It is a good one, and I heartily approve of the design for a dog for small work. To show my approval of it, I will say that in 1868, while working in the "train

room" of the watch factory of E. Howard & Co., Boston, we used a dog made like the sketch, Fig. 1; the large hole forming a spring to hold the dog open, while the piece of work was placed in the smaller hole, the screw being squared, and set up with a key somewhat similar to an old-style watch key.

I thought this dog too slow, and so made them like the sketch, Fig. 2; the

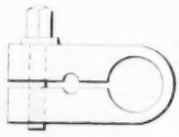

Fig. 1

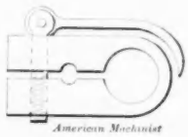

Fig. 2

QUICK-ACTING DOG.

lever having an eccentric formed upon it and pivoted in the slotted end of the screw.

Being only a boy in the shop then, I did not regard this as an *invention*, but it seems to have arrived at that dignity at this late date.

OSCAR E. PERRIGO,
Supt. New Haven Mfg. Co.
New Haven, Conn.

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Link-Slotting Rigs.

Editor American Machinist:

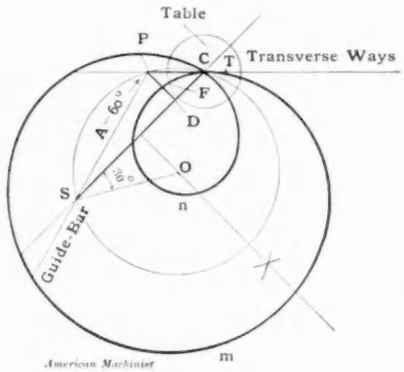
In the two articles on a rig for link slotting shown in the July 8th and October 14th issues there appears to be a radical difference in the designs especially in the location of the center of swing of the angular guide. The latter places this point beneath the tool; the former at some distance away on the line of the transverse ways. The position of this center certainly has some effect on the form of the curve generated by each device and certainly one is better than the other.

An analysis of the curves evolved, which need not be given here, reveals that Mr. Atkinson's device only is able to produce the arc of a circle. In the drawing, the departure of the first curve *F N C M C* from the second *C P S* may be somewhat accentuated, but is entirely correct for the dimensions shown—i. e., both guides set at 60 degrees, the distance from the saddle to the center of the table *S C* common to both, and differing only in the distance *P T*, which lies between the center of guide swing and the tool in the one case, and not in the other. *T* and *P* represent the positions of the tool on the two curves.

But the device presented by Mr. Atkinson is still defective, though it probably may answer all necessary requirements. This defect, while perhaps of little importance practically, leaves something to be desired theoretically, and it may not be amiss to discuss the matter for the interest of those who like that sort of thing. It consists in a gradual narrowing of the slot from the center to each end. Two causes lead to this result.

Generally, in similar circular work we have only angular and radial movements to consider. The work rotates and the tool is set radially, or both these motions are imparted to the tool, and in either instance the center of the work is stationary; but in the case at hand, the center of the work not only rotates on its own center, but also has a movement of revolution about the tool. The logical consequence of this is, that the tool should have a circular outline like an end mill or a circular punch.

The second cause arises when, for any reason, the table is set so that its center



Guide-bar set at 60°.
K = S O.
a = S C = adjustable arm.
S P = guide.
S = saddle.

does not pass under the center of the tool. This offsetting will distort the curve into the form *F N C M C*, as well as narrowing the ends of the slot from the movement of the center of the work, since the amount of offset will vary with the change of position of this center. So, theoretically, the longitudinal slide should be set to its proper position, and be maintained there.

This increases the diameter of the end mill or circular punch to the full width of the slot. There are serious objections to this form of tool, principally because of its size and that it would leave the ends of the slot semi-circular. But these objections can be removed, to some extent, by employing a tool similar to a boring bar with an inserted cutter having a cutting edge which is an arc of the required circle for finishing, using the ordinary tool for roughing. The bar may be turned on its axis for setting or other purpose. The corners may also be fairly cleaned up, especially on the concave face of the slot where the cutter will be cutting on its corner nearest the corner of the slot as they approach; on the convex face the opposite effect will occur, but the cutting edge of the tool need only have half the angular length of the slot measured from their respective centers.

A formula which may be convenient in setting the machine or calculating the radius of the center line of the slot, is,

$$R = \frac{a}{2 \sin. A}$$

where R, a and A are, respectively, the radius, the distance from the pin on the guide slide to the center of the table, and the angle made by the guide and the transverse ways. This formula only applies to Mr. Wilkinson's design. The value of R may vary anywhere between infinity and $\frac{a}{2}$, and the appliance should work satisfactorily through the whole range.

W. E. HUNTER.
Madison, Wis.

▲ ▲ ▲

That Old New Feed Stop.

Editor American Machinist:

Your description of "An Automatic Feed Stop for Lathes" in the October 28th issue, would be "amusing if it were not so sad."

I applied for a patent on this identical arrangement some twenty years ago, and the application was denied because practically the same thing had already been patented by a man in Worcester, Mass., a long time before. In view of this, it would not seem that the device could be reasonably called new and novel. The principle involved was presented in my application in two forms of detail, one of which was exactly as your drawings show, except that the clutch teeth, were clutch pins in my "invention."

The other form of detail in which the invention was shown in the patent application was considered the better, and has from that time to this been used on all the plain turning lathes made by the Pratt & Whitney Company, for whom I was working at the time, and who I suppose felt safe in going ahead with the matter in view of the expired patent of the Worcester man.

It would seem that some of Mr. Wedderburn's methods must have gained entrance to the patent office itself.

WALTER L. CHENEY.

[It will be noticed that we did not introduce the device as "new" or "novel," but called attention to it simply as a recently patented invention. It seems to have interested at least one good reader. —Ed.]

▲ ▲ ▲

Boring-Tools for Lathes.

Editor American Machinist:

In a South German workshop I found a boring-tool in use on an ordinary lathe which has in it the germ of something good.

The main piece is a square Bessemer steel bar, with a slot in each end, across

the diagonal. This slot, for a bar an inch in diagonal, is about three inches deep. In one end there is slid in a double edged cutter of proper diameter for roughing; in the other, one a trifle wider, for the finishing cut; or if the work is good and needs only one operation, then the extra cutter is not needed, but in any case the bar is slotted at both ends and if the cutter is not in the rear end there must be some sort of a strip of steel there for centering. The cutter is centered as shown in the end view, Fig. 1. It is held fast by a set screw.

To guide the bar a cast iron angle piece is fastened to the tool carriage, Fig. 2, and to this is bolted, at the proper hight, a cast iron plate provided with a square hole having two wings, exactly fitting the bar and the cutter. Each guide plate has two holes, for bars of different diameter,

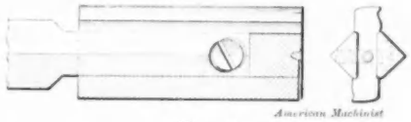


Fig. 1

A GERMAN BORING TOOL.

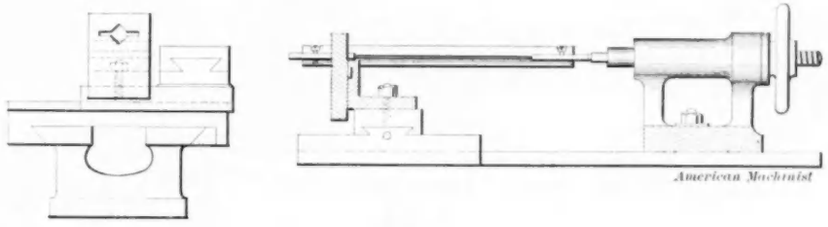


Fig. 2

THE TOOL HOLDER.

the "wings" of the holes can be of a length to take in the widest cutter. It is of course understood that the center of the square hole is at the hight of the lathe centers. The bar is held up at one end by the angle plate and guide plate, and at the other by the dead center; and the tool is advanced by screwing the dead center forward by the hand wheel.

This tool works well in cast iron and in brass, not in wrought iron nor in steel.

Dresden. ROBERT GRIMSHAW.

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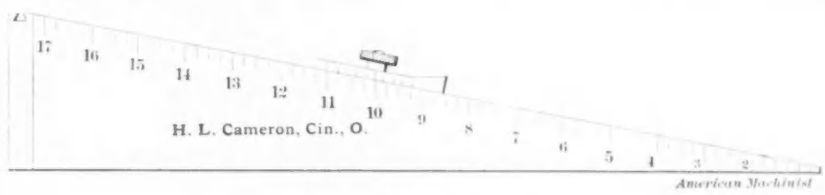
A Planer Tool Gage.

Editor American Machinist:

Seeing in your issue of September 9th an idea of a step gage by John Hoerner, and comments upon it in the issue of September 30th by C. A. Burton, I am led to submit the idea shown in the accompanying sketch.

Mr. Burton remarks that he had seen such a gage that could be made to measure one-hundredth of an inch, and that he saw it eighteen years ago. That, of course, is no reason why Hoerner's gage would not be a good thing for other planer hands to know about, and I think many will feel indebted to him for making it public, and he can easily make his gage to read as fine as may be desired, by putting pieces of paper under it, which pieces have been previously measured by micrometer caliper. It is quite certain that if Mr. Hoerner and others were to be deterred from presenting their ideas for fear similar things had been used before, we would have little use for a good paper like the "American Machinist," and I think you are doing a great service by the presentation of such kinks, and I know of lots of men who take the paper mainly because it does present such ideas.



PLANER TOOL GAGE.

The tool of which I enclose a sketch was devised by Mr. H. L. Cameron, who is the planer foreman at the Bradford Mill Company's shop, in this city, and I think it is in some respects better than the step gage, as it can easily be set to one five-hundredth or one-thousandth. The gage is simply a taper scale graduated in twelve parts to the inch, square with the bottom of scale, and has a little slide upon it that is marked with a Vernier scale. It will be seen that when the slide is moved one-twelfth it raises or lowers the flat surface 1-64 inch, and the cut shows the gage set at 11-16 inch. Mr. Cameron showed me an extra 2-inch slide that he could also attach. Perhaps someone will say that he has seen a gage just like this twenty-five years ago; but Mr. Cameron says he tried to get something like this for several years, and was unable to find it—this fact leading him to make the one shown. The taper is 3-16 inch to the inch.

P. J. FREHILL.

Cincinnati, O.

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Speeding Up by Arithmetic.

Editor American Machinist:

When Mr. William Green bored and turned 30 small gears in 10 hours and 30 larger gears in 15 hours, he consumed, as he states himself, 25 hours. This being correct, it is also correct that he finished in 1 hour 2⅖ gears (not 2½, as stated by the boss); but when he "lumped" the whole lot and made them in 24 hours, he actually finished 2½ per hour, consequently the solution of the "problem" is, that Mr. Green works faster when he "lumps," and does in 24 hours what he formerly did in 25 hours, and if he follows this practice, he does well to "lump" all his work, as he seems to gain time by doing so.

C. CASBERG.

[The lost hour seems to have been sufficiently accounted for. It was, of course, an hour saved rather than lost, and "lumping" may yet prove to be an important invention.—Ed.]

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Chinese and Japanese Appreciation of Engravings.

Editor American Machinist:

One of your correspondents lately referred to the inability of Chinese and Japanese to comprehend our woodcuts and photograps. It is quite natural; they find the same difficulty in understanding our pictures that we do in their drawings. I could not make them out at first, but after spending a short time in China, I got so used to their style of art that our own pictures seemed quite strange for some weeks afterwards. The higher educated Chinese, however, have a keen appreciation of European art, and have apparently always done so; but whether that is due to our own being really better, or solely to its coming from the other side of the world, is more than I know.

C. PURCELL TAYLOR.

London.

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The Pittsburg Reduction Company is now quoting rolled sheet aluminum at prices which, while higher per pound than those for sheet brass, are cheaper per square foot for sheets of the same thickness; that is to say, the price of aluminum sheets is not so high, compared to the price of brass sheets, as the specific gravity of brass sheets is when compared to the specific gravity of aluminum sheets, so that for any purpose where a piece of sheet metal of a given size and thickness is to be used, aluminum will now be the cheaper material, and in many cases will undoubtedly also be the better one.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,

256 Broadway, New York.

John A. Hill, President and Treasurer.

C. A. Hansmann, Sec'y.

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Naval Engineers' Titles.

We note that Commodore Melville, in his recent report, stands by his guns, in again insisting that naval engineer officers should have real instead of sham rank and titles, and that their numbers should be increased.

In the "Atlantic Monthly" for September is an article by Professor Hollis, who was formerly a member of the Engineer Corps, in which article he advocates a plan which would virtually abolish all distinction between line and engineer officers by making them all engineers—as least so far as the naval academy course could do that. Prof. Hollis' article is a very able one, and although it is opposed, and in some cases ridiculed, by line officers, it is, nevertheless, one worthy of serious consideration. Prof. Hollis shows, by reference to the history of navies, that where a change of motive power has been introduced, it has been accompanied first by separation into two classes, the one looking after the propulsion of the ship, and the other the fighting. Then, as time went on, it was found that the people who did the propelling could add to this the fighting side of the business, and finally the two were amalgamated. This is the actual history of the sailing navy, which has disappeared only within the last few years.

On the ground of efficiency, it is shown that the modern man-of-war has become a mass of machinery from end to end. Everything in her is now done by machinery. Even the guns, which at one time were tubes without a semblance of mechanism, have now become machines, in many cases of great complication, and there are a number of other machines which have to be handled by the deck officers, such as the torpedoes, torpedo charging gear, search-lights, etc., etc. It goes without saying that these would be handled far more efficiently by men trained as engineers than by those who have had no such training, or to whom it is distasteful. As an actual fact, it would probably be admitted by most line officers to-day, if asked by a friend whom they did not suspect of getting information for ulterior purposes, that the most efficient line officer is one with a natural aptitude for machinery.

Complaint has been made a great many times that our ships were carrying around a number of officers (meaning the engineers) who, while they had important duties to perform, were, nevertheless, somewhat one-sided, in that they could not be sent ashore to command an expedition, nor could they take charge of a gun's crew on the ship in case of accident to the regular officer in charge of that duty. Under the system proposed in this new plan, every officer graduated from the navy would be competent to command men for any military duty now carried out by naval officers.

It is a lamentable fact that, at the present day, most commanding officers look on the engineers and their men as an entirely separate organization, carried in the ship as a disagreeable necessity. Very few, if any, commanding officers know enough about machinery to really appreciate the reports made to them by the chief engineers; so that things evolve themselves into two cases—one where the captain follows blindly all the recommendations of the chief engineer, and the other where he approves or disapproves, according to his whim.

If the plan proposed should be adopted, every commanding officer would have had the same early training as the chief engineer of his ship, and, in addition, during twelve years after graduation, would have had a great deal of duty in connection with the machinery. As a result he would be qualified to discuss matters intelligently, and would look on the machinery as just as much belonging to him as the guns, and would consider the men of the engineer's force as truly his own men as he now does the men at the guns.

It seems as though this would remove nearly all the causes of friction that now exist, so that there ought to be the best state of feeling among all the officers of the service, and a united effort for the highest efficiency.

We think that Prof. Hollis' article thoroughly demonstrates that, as a matter of right and expediency, the engineers of the navy should have rank and title equal to that of other officers, and much more in keeping with the important duties they have to perform than those they now hold; but, still, we think that the original plan of keeping the real engineer officers distinct from the others, and giving them genuine rank and title, distinguished by the sub-title "Engineer Corps," is the wisest plan, and that it will work well in practice is, we think, proven by experience in the army, which follows just that plan, and has no difficulty with it. The time may come when real engineers connected with the navy will very much desire a distinguishing title belonging exclusively to themselves.

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Poems by L. B. Moore.

Very many of our readers are more or less acquainted with Mr. L. B. Moore, who for many years was an officer of this company, and his friends will perhaps share our grateful surprise in being made aware that Mr. Moore has of late been cultivating the poetic muse. Before us lies a modest volume, entitled "The Death of Falstaff, and Other Poems," by L. Bruce Moore. We do not know whether these poems, measured by the standard of the literary critic, would be called great, or not, but we do know that we have derived genuine pleasure from the reading of most of them. The volume is beautifully printed and bound, and is published by Cushing & Co., Baltimore, Md.

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Death of Paul Pryibil.

Paul Pryibil, the well-known builder of wood working machinery, died at his home in this city on October 28th. Mr. Pryibil was born in the German Duchy of Nassau, in 1834. He learned the machinist trade in the old country, and came to New York in 1855. He began to work at his trade and later became known through several inventions and began business for himself. Later Jacob First was a partner in the business, which has gradually developed to its present proportions. Mr. Pryibil is succeeded in the management by his two sons, Albert and Paul.

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Personal.

Mr. Thomas J. Hendey, for some time foreman of the tool room of the Hendey Machine Company, has accepted a similar position with the Russell Nut and Bolt Company, Port Chester, N. Y.

Mr. Geo. A. True, who has been with the Whiting Foundry Equipment Compony, Harvey, Ill., as chief mechanical

engineer, has accepted a similar position with the Frontier Iron Works, of Detroit, Mich.

Passed Assistant Engineer J. C. Leonard, U. S. N., has been ordered to the New York Navy Yard.

Mr. Benbow, president of the Otis Steel Company, Cleveland, O., was struck by a train, November 3d, in Cleveland, and at this writing is not expected to survive.

Our correspondent, J. L. Lucas, has left the employ of the Mossberg & Granville Company, and has started a business of his own in tool making, die and press work, at 92 Westfield street, Providence, R. I.

We will consider it as a favor if our readers will send in items of news regarding changes of foremen, superintendents or others prominently connected with the machine business. Such items are legitimate news of the trade, and we are glad to make room for them.

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Technical Books.

DIES AND DIE MAKING. By J. L. Lucas. 100 6 x 9-inch pages; 107 illustrations. Cloth, $1.

A portion of the contents of this book will be familiar to our readers, since its author frequently contributes to our columns, and in his book has used some of that material, adding to it sufficient matter to make a book which can scarcely fail to be of great value to those who have to do with the making and using of dies for any purpose. Mr. Lucas takes up his subject with the selection and treatment of steel for dies, and then goes on to explain the methods of making good working dies, from the plainest and most simple example to the most complex forms called for by modern manufacturing methods. The book is written by a mechanic who understands his subject thoroughly and by wide practical experience. It is published by the author, at Providence, R. I.

EUCLID: BOOKS I-IV. By Rupert Deakin. 309 5 x 7-inch pages. Hinds & Noble, New York. Price 70 cents.

TRIGONOMETRY. By William Briggs and G. H. Bryan. 326 5 x 7-inch pages. Hinds & Noble, New York. Price $1.

The above books are two new numbers of the English "Tutorial" series, which are prepared with special reference to the English system of examinations of students who have prepared themselves by private study. They are equally well adapted to the uses of American students devoting their spare hours to study, and will be found superior to school text books for that kind of work.

A good deal of attention is paid to the analysis and comparison of the various methods of proof, with a view to suggesting the methods of attacking the numerous problems given. In this respect there is a wide departure from the methods of the usual text books, which cannot be otherwise than helpful to the student without a teacher.

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Obituary.

Col. Henry T. Russell, vice-president and general manager of the Union Drop Forge Company, died suddenly in Chicago on the 5th inst., aged sixty-four years. He leaves a wife.

Joseph Hunt, civilian Inspector of Armor Plate, appointed in the term of Secretary of the Navy Herbert, died on the 7th inst., at Allentown, Pa., aged fifty-four years. He formerly was superintendent of iron furnaces at Richmond, Va.; Bingen, Catasauqua, and Emporium, and of the Allentown Foundry and Machine Works. He served during the war as engineer on the Polaris, in blockade duty.

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August Wilson, boiler maker, and William O'Hearn, water tender of the United States monitor Puritan, have been recommended to the Navy Department for medals of honor for heroic service. It is reasonably certain that they saved the lives of several shipmates, when the crown sheet of one of the boilers gave out some time ago. Wilson opened the watertight door leading to the deck companionway and helped several to escape. He and O'Hearn groped through the blinding steam and closed the valve connecting with the other boilers. Engineer Cowie, it will be remembered, was severely scalded on that occasion.

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Commercial Review.

NEW YORK, Saturday Evening, Nov. 6.

DYNAMOS AND MOTORS.

The last half of 1897 has been proving itself a good season for the electrical manufacturers. Business, as generally experienced by the important concerns, is excellent. Lighting, power and street railway work have all felt it. The time for the heaviest rush of business in this locality seems to be over, though some concerns appear to be as much taken up with orders as ever. Quite a bevy of lighting generator orders for office buildings was flushed during September, or thereabouts, as noticed in our last monthly report. Others are yet to come, but it does not seem to be the time to close them up just at present. The motor business is still good, although for that also, the height of the season appears to be past. November will doubtless be a month of fair sales, and in December it is to be expected that buyers and sellers will take a breathing spell.

All in all, the situation is most satisfactory, and when the proper time comes for a still greater rush of trade, we shall doubtless see it. As the representative of one of the leading Western companies informs us, brilliant hopes are to be entertained of the further triumphs next spring has in store. But this doesn't mean, we presume, that people are going to hibernate in the meantime.

There is said to be a heavy demand for incandescent lamps at present.

PRICES

of electrical machinery, as everybody conversant with the subject knows, have been rendered, by the past years of business depression, fearfully and wonderfully low. Now the question which naturally arises is, Will we have to pay more money for our dynamos and motors, as we will for our vests and trousers? To some extent this may come to pass, but it is not unlikely that prices will permanently remain upon a pretty low basis. The depression has had the result of teaching economy in manufacturing methods, and dynamo builders will be able to keep on furnishing machines to their customers at cheap rates, and yet with profit to themselves.

DOMESTIC ORDERS FOR ELECTRICAL MACHINERY.

The General Electric Company are doing some rather important work for Buffalo and Niagara Falls. Five additional transformers of 1,250 horse-power each are being built for the power-house of the Cataract Power and Construction Company, at the falls. They are used for raising the voltage of the current there generated to 11,000, with a three-phase current. More cable for transportation of the current to Buffalo is being supplied. There are 24,000 feet of it, and it is insulated up to 25,000 volts, which is claimed to be the highest insulation ever constructed. Three of the General Electric's transformers are already in use at the power-house. For use at the other end of the line by the Buffalo City Railway Company, two rotary converters, of 500 horse-power each, reducing to 375 volts alternating current, are being added. This will make a total of 2,000 horse-power of the same. There are being furnished, also, three transformers for changing the current of 11,000 volts to 375 volts for the rotary converters.

Among the work of other companies is mentioned the supply of electrical machinery to steel works, to a silk mill, etc.

FOREIGN BUSINESS.

The manager of the export branch of a prominent local company tells us that they have recently established 75 or 100 new agencies and connections, which, we believe, are principally in the Spanish American countries. He says that the effect of our new tariff in that field is, to cause some hesitation in business, since people are waiting to see what measures of reciprocity may be adopted.

The Fort Wayne Electric Company, who have been very busy of late—so much so, in fact, that they have been unable to retain anything in stock—have this season sent some electric lighting

plants to Spanish America. One went to Buenos Ayres, another to Curaçoa, and an order has also come from the State of Michoacan, Mexico, for a municipal lighting plant to be installed in its capital town, Morelia.

H. B. Coho & Co., agents for the Eddy machines, have made a sale of motors, etc., to the amount of about $10,000, for use in a cordage factory in Mexico. The high rates of exchange with this country have had a tendency to stimulate Mexican home industries, though we do not know that the establishment of the one alluded to is owing to that cause.

The agriculturists in Saxony are giving a great deal of attention to the use of electricity in agriculture, and it is finding much favor with them. Recent experiments in threshing by electricity have given surprisingly good results—so much so that it is said that in several sections

(Continued on page 35.)

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Business Specials.

Gear wheels, gear cutting. Grant; see page 16

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Dies & Die Mak'g, $1. J. L. Lucas, Providence, R.I.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

M'ch eng, 2 yrs exp, pos as dft'n. Box 75, AM MACH.

Situation wanted by exp. mechanical draftsman; technical graduate. Box 74, AMERICAN MACHINIST.

Young man, all-round machinist, 10 yrs exp on fine and comp. mchs, wants sit. Box 76, AM MACH.

Pos. wanted by a young man as an iron molder; Eastern States pref.; ref. g ven. Box 62. AM. MACH.

Wanted — Position as travelling salesman in machinery line by young man with 7 years experience. Box 72, AMERICAN MACHINIST.

Skilled designer of special machinery will be open to engagement December 1st. Address "Record," care AMERICAN MACHINIST.

Draughting or other engineering position by first class man; 11 years' experience and engineering education. Box 78, AMERICAN MACHINIST.

If you need a capable mech'l engineer and draftsman with wide experience and technical education, address Box 79, AMERICAN MACHINIST.

Wanted—Situation as pat. and template maker 16 yrs exp pumps, eng. and gen. mach.; 4 yrs. exp. on bridges and buildings. Add. Box 77, AM. MACH.

Correspond'e wanted with firm des. trav. engr. to handle wtr. whl. plants, pr. trans. mchy & elec. ap.; varied exp., drf. rm., shop & ins. Box 57, AM. MACH.

Wanted—Position by experienced machinist on grinding machines, milling machines and their fixtures, also mchy for making form cutters and hubs; used to handling help. Box 71, AMER. MACH.

Wanted by practical machinist of eighteen years' experience on high speed engines, dynamos, motors, etc., situation as foreman or assistant superintendent; can furnish first class references. "W.," Box 73, THE AMERICAN MACHINIST.

Wanted—Position as manager of a foundry plant, being a practical mechanic in foundry practice, heavy or light work, iron or brass, green, dry sand or loam, for a number of years past have had complete management of an iron and brass foundry, buying, selling, contracting, etc.; can refer to owner of that foundry and others as to mechanical and executive ability, sobriety, etc. Ad. Box 69. AM. MACH.

Help Wanted.

Wanted—Traveling salesman, one who has had exp. in selling cranes preferred. Box 80, AM. MACH.

Wanted—For Ohio, 6 first-class die makers on sheet metal tools; none others need apply; send reference. Box 68, AMERICAN MACHINIST.

Wanted—Foreman for shop tapping iron pipe fittings, valves, etc.; must be good mechanic and capable of handling men; refs. Box 67, AM. MACH.

Wanted—Energetic, reliable representative expd. in fan work to take charge of branch office. State previous business connections, salary received, age and reference. Buffalo Forge Co., Buffalo, N. Y.

Wanted—A first-class salesman who is thoroughly familiar with punching presses and rolling mills; first-class refs. Send photo. with particulars to Mossberg & Granville Mfg. Co., Providence, R. I.

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Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis

Caliper Steel, 6 Prs., assorted; mailed $1; finest stock. Box 61, 96 Park Row, N. Y.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Machinery to order, inventions developed. Leland, 469 Van Buren Street, Brooklyn, N. Y.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

For Sale—Small machine shop, having good repair trade, in town of 14,000 inhabitants; no opposition. Box 42, AMERICAN MACHINIST.

Wanted—To manufr. for respons. parties sheet metal stamps, ptns, models, dies for metal, leather, cloth or paper. Bell Elec. Co., 46 E. 14th St., New York.

For Sale—A foundry fitted for making light gray iron castings with fine stock of patterns. A well equipped jobbing machine shop attached. Box 70, AMERICAN MACHINIST.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C Wormer Machinery Co., Detroit, Mich.

Small Manufacturers Wanted—The business men's association of one of best cities in middle West solicits correspondence with parties seeking new location for mfg. enterprises. "Business," AM. MACH.

To Let—Two large light loft bldgs. for mfg. purposes. Will put in power to extent required. 20,000 sq. ft in bldg. opp. Fulton Ferry, Brooklyn; 12,000 sq. ft in bldg near Broadway Ferry, Brooklyn. F. X. Sadlier, 533 West 55th Street, New York City.

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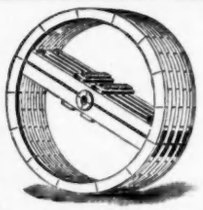

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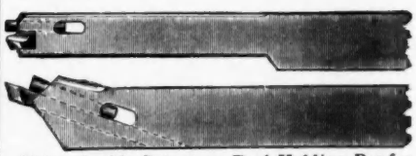

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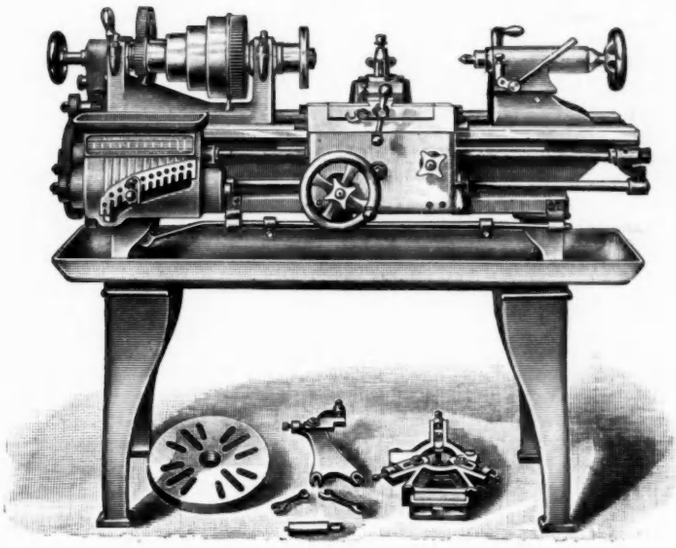
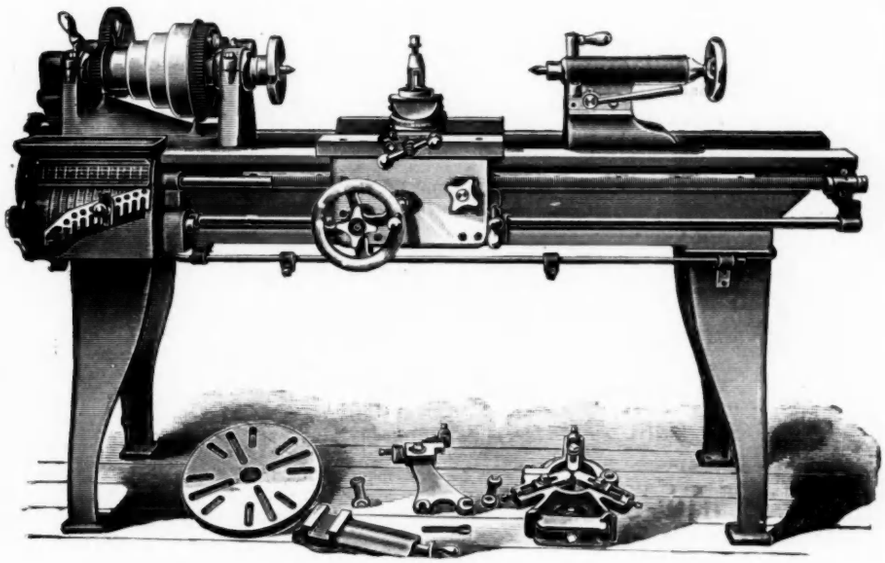


12" Hendey-Norton Lathe

is fitted with drawing-in sleeve and American Watch Tool Co's standard chuck, used in making small taps, reamers, etc. Work finished first and cut from bar afterwards. No centering required. See carriage reverse lever by right-hand side of apron; no reaching for countershaft shipper required.



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(Continued from page 34.)

of the country threshing will be done by electric power exclusively hereafter.

A COMMERCIAL AGENCY IN MEXICO.

President Diaz, of Mexico, has conceded to Francis B. Purdie, who represents R. G. Dun & Co., permission to establish a mercantile agency in that country. It is said that the organizers already have correspondents in nearly every place of importance in Mexico, and soon will be ready for business.

NOTES FROM CINCINNATI.

The present autumn has seen heavy sales of pig iron in Cincinnati, which was, to a considerable extent, owing to the demand for agricultural implements. Railroad companies have placed large orders for cars, and improved sales of structural material have been made for bridge purposes. Rolling mills have been kept busy turning out finished products of iron and steel.

There has also been a better demand for engines, machine tools and other machinery. Various concerns with whom a correspondent of the "American Machinist" communicated reported sales as having shown a marked increase this season. At least two of the tool-building shops, those of Dietz, Schumacher & Boye, and the Davis & Egan Machine Tool Company, are finding it necessary to increase the size of their works. J. M. McGowan & Co. have received many contracts for their engines and pumps for water-works plants, and have orders for the latter for the Johnston Building and the Grand Hotel, to be used in elevator work. The latter building is to put in a plant for manufacturing ice. The J. A. Fay & Egan Company have had on hand a large order for wood-working machinery for the Siberian Railway, and are expecting others. The Queen City Supply Company reported improvement in machinery, railway supplies, etc. So did Samuel C. Tatum & Co., for the machinery castings, etc., which they make. It may be mentioned that Proctor & Gamble, at Ivorydale, are putting in four 250 horse-power boilers. The fall meeting of the Western Foundry Association, held in Cincinnati this year, was an event of much interest to the visitors.

Quotations.

NEW YORK, Monday, November 8.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ $12 00
No. 2 foundry, Northern	11 25 @ 11 50
No. 2 plain, Northern	10 75 @ 11 00
Gray forge, Northern	10 25 @ 10 50
No. 1 foundry, Southern	11 00 @ 11 25
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 25 @ 10 50
No. 1 soft, Southern	11 00 @ 11 25
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, or No. 4, South'n	10 00 @ 10 25

Some furnaces have begun to shade these prices.

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.50 @ 1.60c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2½c.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10⅝ @ 10¾c.; casting copper, 10⅝ @ 10½c. for ordinary brands.

Pig Lead — Carload lots, 3.87½ @ 3.90c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.75 @ 13.80c., f. o. b.

Spelter — Carload lots, 4.10 @ 4.20c., New York delivery.

Antimony—About 7¾c. and upwards for Cookson's; 7⅝c. and up for Hallett's.

Lard Oil—A good commercial brand of prime city, ice pressed, is quoted at 40c., wholesale; ordinary present make, 2 @ 3c. less.

▲ ▲ ▲

Manufactures.

At Penn Yan., N. Y., S. L. Pratt is to erect a new factory.

Francis B. Torrey, of Bath, Me., is to erect a new foundry.

The Kostenbader Brewery, at Catasauqua, Pa., is being enlarged.

At Sherbrooke, Que., the Q. C. R intends to construct new car shops.

W. A. Patterson, Flint, Mich., is adding another story to his factory.

The planing mill of F. Lang, McKeesport, Pa., has been destroyed by fire.

The plant of the Brantford (Ont.) Plow Works has been destroyed by fire.

Cnopins & Co. are to erect a flouring mill at Santa Rosa, Cal., in a short time.

The power house of the O. & N. tunnel, at Ouray, Col., was burned down recently.

The Wollful Leather Company, of Morris, Ill., lost its entire plant by fire recently.

Fels & Co., of Philadelphia, Pa., are to erect an addition to their factory, 57 x 121 feet.

B. F. Coburn, of Hopkinton, Mass., proposes to remove his factory to New Albany, Ind.

R. M. Clough, recently of New Haven, Conn., has moved from that place to Tolland, Conn.

The Putnam Manufacturing Company, Putnam, Conn., is to erect an addition to its plant.

Koehler Bros.' foundry, on South Tilden street, Saginaw, Mich., has been destroyed by fire.

Markey & Jones contemplate the erection of an annealing furnace factory at Anderson, Ind.

An addition will be built to the plant of the Trump Bros.' Machine Company, Wilmington, Del.

The Reading Railroad Company is to add new machinery to its wood-working department.

The plant of the Colebrookdale Iron Company, at Colebrookdale, Pa., is being improved.

Charles Techner & Co., of Philadelphia, Pa., contemplate the erection of a silk yarn dyeing factory.

The Terrell Electric Light & Power Company, Terrell, Tex., will place additional machinery.

The American Steel Barge Company, Superior, Wis., is to erect a machine shop, 84 x 150 feet.

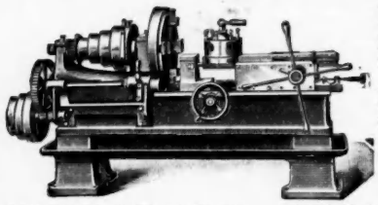
The Holley Metal Company, of Newport, R. I., contemplates the erection of a new building.

The Sacandaga Mining & Milling Company is erecting buildings at its gold claim at Hadley, N. Y.

The Reading (Pa.) Iron Company is to erect a building at Eighth and Buttonwood streets, that city.

The foundry of Bonnet & Nance, Quincy, Ill., recently burned, is to be rebuilt on the same site.

FACING AND CHUCKING MACHINES.



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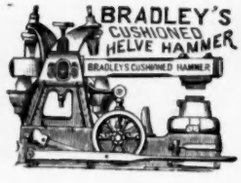

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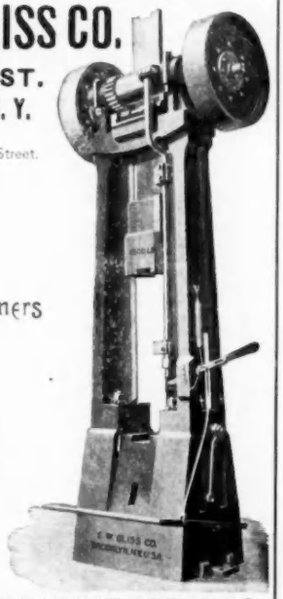

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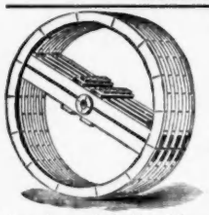

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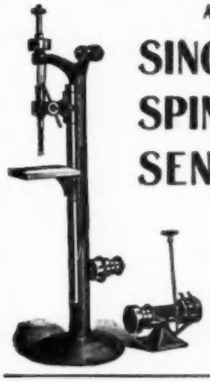

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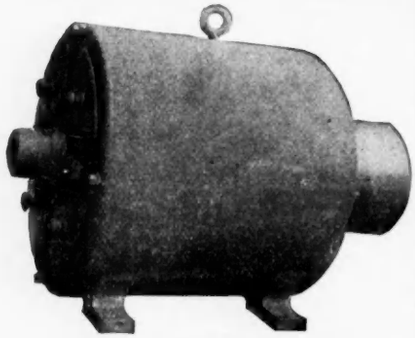

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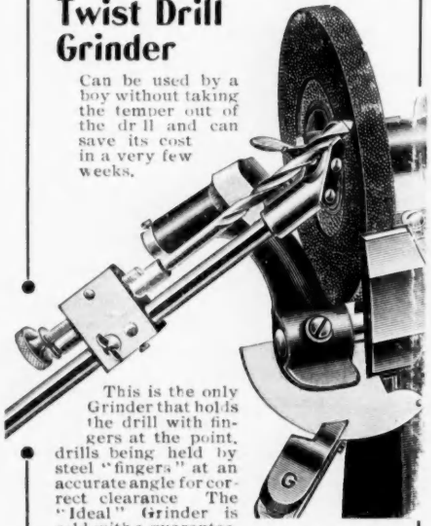

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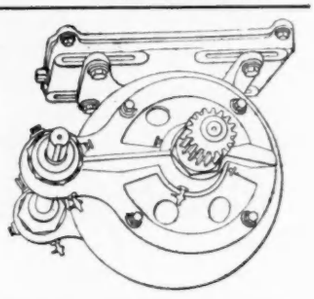

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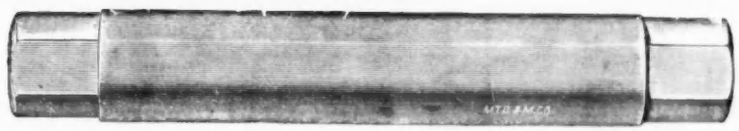

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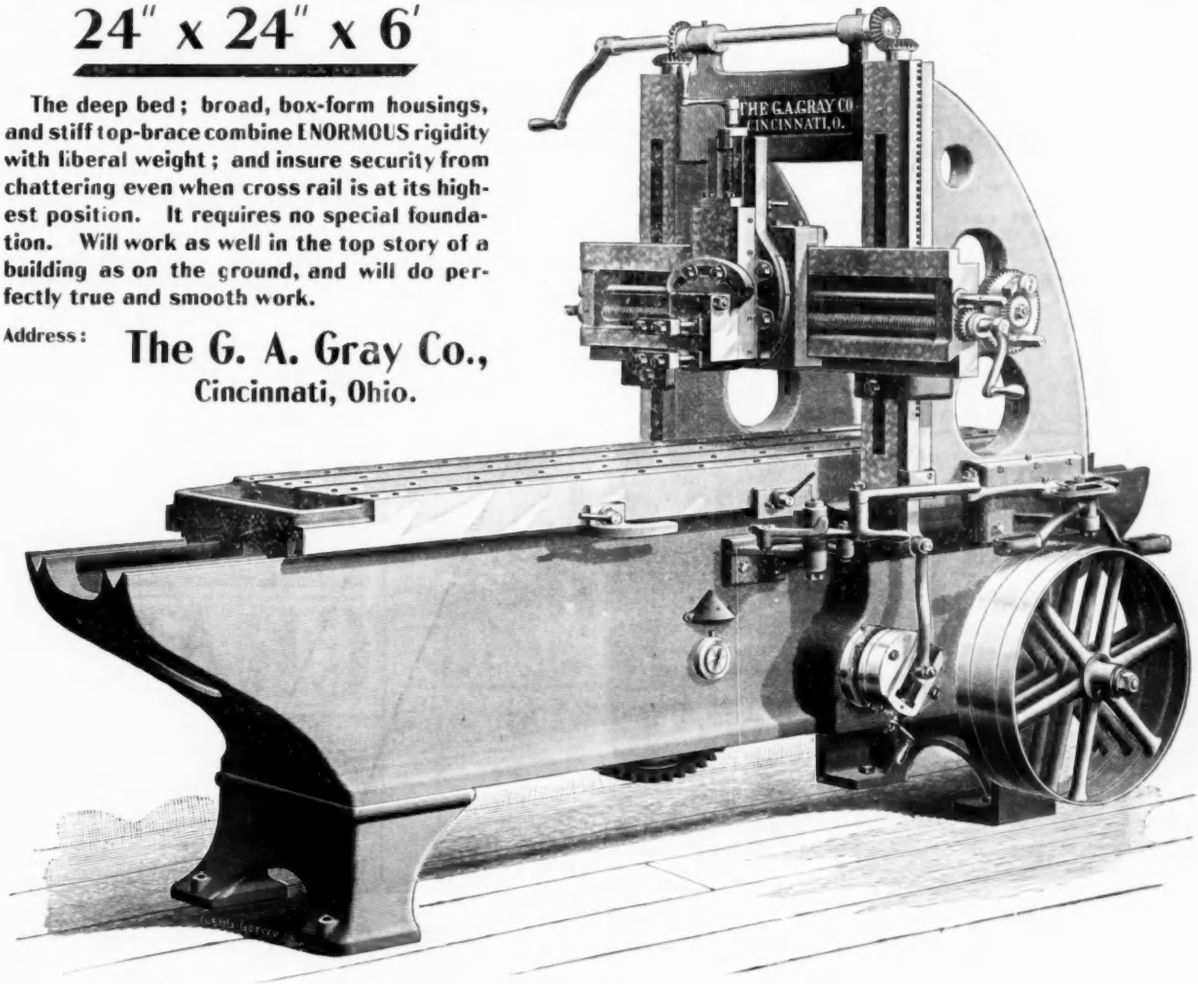

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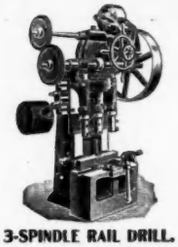

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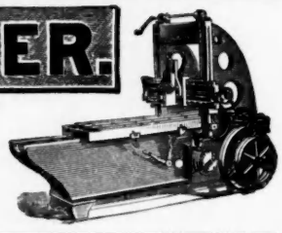

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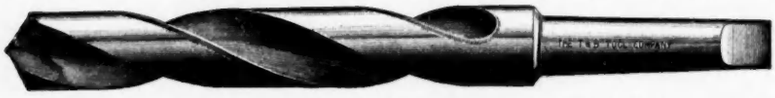

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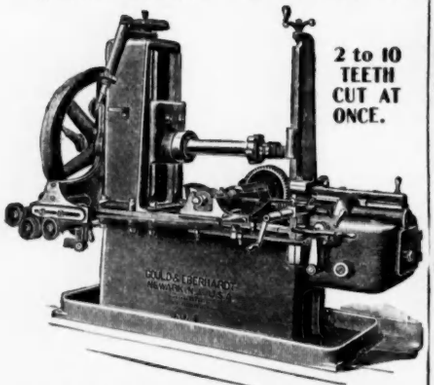

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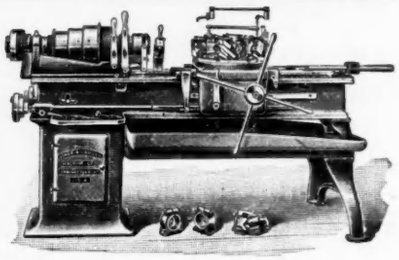

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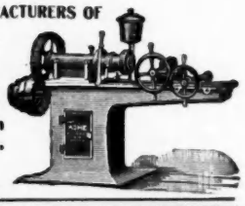

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